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WALTER M. SOLOMON, M.D.

Cleveland, Ohio

Printed in U.S.A.

Postgraduate Course in Physical Medicine and Rehabilitation

UNIVERSITY OF TEXAS, MEDICAL BRANCH, GALVESTON

MARCH 1-5, 1948

PROGRAM

All meetings, unless otherwise stated, will be held in the Amphitheater, 4th floor, Outpatient Building.

Monday, March 1st —

8:00 Registration

Morning Session — Wilbur A. Selle, Chairman

9:00 Opening Remarks.....Truman G. Blocker and Chauncey D. Leake
9:15 Clinical Application of Physics and Physiology in Physical Medicine.....Arthur E. White
9:45 The Relation of Physical Medicine to Other Fields of Medicine.....Ben L. Boynton
10:10 Recess
10:20 Present Status of Fever Therapy.....H. Worley Kendell
10:50 Assistive and Supportive Apparatus in the Treatment of Muscle and Nerve Injuries.....Robert L. Bennett
11:20 Work of the Council on Physical Medicine.....Frederick A. Jung
11:50 Question Period

Afternoon Session — Edward Randall, Chairman

1:30 Instructional Period: Medical Diathermy.....Stafford L. Osborne
2:15 Fundamentals of Massage.....James B. Mennell
2:45 Question Period and Recess
3:00 Ultraviolet and Infra-red Therapy.....Richard Kovács
3:45 Progress and Future Objectives of Physical Medicine in the Veterans Administration.....A. Ray Dawson
4:15 Question Period
4:25 War Department Sound Motion Picture

Evening — Hotel Galvez — Movies

Tuesday, March 2nd —

Morning Session — Ben Boynton, Chairman

8:15 Instructional Period: Room 112 Laboratory Building, Physiological Basis of Therapeutic Heat and Cold.....Wilbur A. Selle; Local Application of Heat and Cold.....Louis P. Biro
9:00 Physiology of Normal and Atrophic Muscles and Its Application to Clinical Medicine.....Lt. Col. James E. Tate
9:30 Dynamic Physical Reconditioning.....Major Edward F. Quinn
10:00 Question Period and Recess
10:15 Manipulation of Joints of the Upper Extremity.....James B. Mennell
10:50 Occupational Therapy.....H. Worley Kendell
11:30 The Contact Splint.....George W. N. Eggers
11:50 Question Period

Afternoon Session — Oscar O. Selke, Chairman

1:30 Instructional Period: Principles of Muscle Testing and Muscle Reeducation.....Robert L. Bennett
2:15 Electrical Stimulation of Muscles.....Stafford L. Osborne
2:45 Question Period and Recess
3:00 Bulbar Cases of Poliomyelitis.....Clifford G. Grulee
3:30 The Increasing Need for Medical Rehabilitation in General Practice as Indicated by Experience of the Veterans Administration....Alvin B. C. Knudson
4:00 Unsolved Problems in Physical Medicine.....Frederick T. Jung
4:30 Question Period

Evening — Hotel Galvez — Entertainment

Wednesday, March 3rd —

Morning Session — H. Worley Kendell, Chairman

8:15 Instructional Period: Room 112, Laboratory Building, Essentials of Hydrotherapy.....Oscar O. Selke
9:00 Clinical Application and Significance of Electromyography.....Harry D. Bouman
9:30 An Ideal Treatment Program for Poliomyelitis.....Robert L. Bennett
10:30 Question Period and Recess
10:45 Ion Transfer.....Richard Kovács
11:15 Aspects of Functional Anatomy of the Lower Extremity.....Donald Duncan
11:35 Gravitational Edema.....Truman G. Blocker
11:50 Question Period

ABUSES AND PITFALLS OF PHYSICAL MEDICINE *

RICHARD KOVÁCS, M.D.

NEW YORK

Physical medicine in the United States during the past half century has progressed from predominant empiricism, through a stage in which the physiologic effects of the different physical energies became fully recognized and the need for a careful technic established and now is evolving quantitative observations and measurements to form the basis for analysis and theory. As all departments of therapeutics developing through trial and error, it had to overcome fallacies, ignorance and some outright misuse. Even at this advanced stage pitfalls threaten the unwary. The object of this presentation is to review some of the errors of the past and to point out safeguards for safe and efficient employment in the present.

Electrotherapy

Electricity, with its mysterious nature and sometimes awe-inspiring manifestations, has been used for curative purposes for many centuries by earnest medical men with due restraint, and by all shades of overenthusiasts and downright charlatans with abandon. Some of the notorious examples of the latter category have become a matter of historical record. To the American practitioner Elisha Perkins belongs the doubtful honor of having invented and exploited for the first time on a large scale a quack electric appliance, the electric "tractors": two little rods of metal claimed to "draw disease from the body" when applied to it. Although discredited in due time, the "tractors" became the forerunners of many other fake devices, ranging from crude "electrical rings" and "magnetic belts" to "magic horse collars" — simple coils of insulated wire to be hung round the neck of the gullible — leading up to the rankest piece of quackery of our generation, the "electronic" reactions of the renegade physican Albert Abrams. It is little known in the United States that the rise and fall of Abrams quackery was duplicated abroad by an Austrian layman, Zeilleiss, using a contraption on the order of the "violet ray" outfits sold in drug stores a few years ago and named "oscillators." At the height of Zeilleis' popularity he administered some 3,000 treatments during an eight hour working day, allowing just a few seconds for each patient, a procedure strangely reminiscent of the exploits of a "foot-twister extraordinary" in neighboring Canada, at $1.00 per foot, a few years ago.

The multitude of fake electrical devices exploited for healing and the ever present possiblity of still bigger fakes represents a serious blot on the supposed intelligence of the general public. While it is true that in the long run all these fakes have gone down in disgrace, this occurred only after much sad disappointment to many sufferers and much expenditure in effort and time which could have been utilized much better along constructive lines. A tragic demonstration of the fact that in the hands of an inexperinced lay person even a supposedly harmless violet ray machine may become a weapon of death, was furnished a few years ago by an accident reported in a newspaper story captioned: "'Electric Shock Kills Pastor.'" The Rev. L. G. W., of Long Island, was found dead in his room, with a metal plate on the back of his neck, slipped under the collar and held in place by a scarf. A wire led from this plate to a radiator. On the deceased man's neck was the handle of a violet ray machine held by his left hand. Autopsy showed first degree skin burns and acute congestion of the brain, liver and kidney. Recon-

* Read at the Twenty-Fifth Annual Session of the American Congress of Physical Medicine, Minneapolis, Sept. 4, 1947.

struction of the sequence of events showed that the deceased attempted to treat a pain in the back of his neck with the violet ray contraption. In the belief that "grounding" would increase the strength of the current, he rigged up the connection between the radiator and the metal plate on the back of his neck. No better way could have been devised to conduct the alternating current from the return ground through the heart area. Hence, as soon as the current flow was started it caused fibrillation of the heart, leading to instant death without giving the victim a chance to disengage himself from the fatal circuit.

Turning from outright quackery, it is instructive to review some of the empirical notions and unfounded assertions of apparently sincere clinicians during the evolution of electrotherapy.

As to the time-honored methods of galvanism and faradism, we can read in even comparatively recent times in a widely used textbook on electrotherapeutics, published by Haynes in 1896, such speculative statements as: "It is believed that the galvanic current penetrates the substances of the brain while the faradic current is distributed chiefly to the membranes"; also, "This rule has been given for the use of galvanism in insanity: recent cases and functional diseases are benefited by it while old cases and structural diseases resist its influence." No wonder that well known neurologists recommended the use of electricity more or less in the form of a placebo or as a convenient means of disguising suggestive therapeutics and gave blanket recommendations for its use without specifying its form and without any reference to technic.

Static electricity had its greatest popularity toward the end of the last century and during the first ten years of this century. No office of any self-respecting physician in the large eastern cities seemed complete without the presence of one of these bulky machines. Static electricity was undoubtedly most useful through its mechanical effects, its condenser discharge being a precursor of the present day low frequency muscle stimulation. However, the most impressive and even to this day not fully explained effect appeared to be the high voltage condenser discharge spreading all over the body. Ardent advocates of the static wave current would claim to cure with it everything from goiter to diabetes.

Low frequency currents in their gradual evolution from the original faradic current and the simple make-and-break of the galvanic current to the present day electronic production of every conceivable wave form, gave rise to many misconceptions. An apparatus for faradic contraction of large muscle groups, first advocated by the Frenchman Bergonie, served for a long time as standard equipment in "fat-reducing" studios. It is being replaced these days by so-called "slenderizing" machines, using thermionic tubes to produce a surging current. In the past decades, manufacturers of apparatus have competed to turn out a bewildering variety of heterogeneously labeled low frequency currents, with no clear cut physiologic or clinical indications for their use. Modern research in the physiology of electric muscle stimulation under normal and under pathologic conditions is now gradually clearing up much of this confusion and is offering low frequency apparatus of definite control as to frequency, duration and energy peaks.

The advent of high frequency electricity during the second decade of this century completely overwhelmed the medical profession for a while. Manufacturers of apparatus and their sales agents were determined to leave no doctor's office without a diathermy machine. Traveling agents and itinerant lecturers carried on intensive sales propaganda claiming all-curative medical and surgical uses for this new form of treatment. I vividly remember the

early years after World War I, when many misinformed medicos from country places would write in for special courses on removal of tonsils and hemorrhoids by surgical diathermy. As a result of misuse by the untrained, law suits for diathermy burns, medical as well as surgical, began to mount; in many cases after initial failures, diathermy machines were pushed into corners by their owners to gather dust.

Another spurt in exaggerated and, at times, false propaganda, occurred when short wave diathermy came into vogue fifteen years ago. Not only eager manufacturers but also enthusiastic medical workers asserted that these waves were different from all other physical therapeutic agents, especially from those of long wave diathermy. One could read statements like this: "It is no exaggeration to call short wave diathermy the greatest discovery of physical medicine since the work of Roentgen," and "Every normal tissue cell has a radio frequency of its own, and by application of short waves of proper frequency any abnormal tissue may be restored to function." Within three years some 1,000 articles appeared in the medical literature on "short waves." The flooding of physician's offices with short wave apparatus fostered the belief that use of such was all there is to physical therapy and led to the neglect of other indicated measures. No wonder that, when, at the outbreak of World War II, steps were taken to take a census of diathermy apparatus — first for purpose of national safety, and later, for the diminution of radio interference — it was found that some 2,200 hospitals and over 50,000 physicians, one out of every four physicians in the United States, possessed such an apparatus. Short wave diathermy in the hands of the inexperienced becomes generally little more than a glorified heating pad, applied in a hit or miss manner, because of the crude method of estimation of dosage and the lack of appreciation that treatment of different pathologic conditions requires clinical judgment and experience.

One of the worst things about diathermy propaganda became its abuse for the exploitation of the general public. Unscrupulous manufacturing and sales concerns have found a lucrative field in promoting the sale of small machines for "home use" by radio and other advertising. The fact that diathermy treatment is used by competent physicians in many chronic ailments is juggled by the crafty salesman with the notion that a lay person can diagnose his own illness, decide that it needs diathermy and then proceed to apply it himself.

The laxity of the law governing radio advertising delayed effective protection of the public inauguration of the Food, Drug and Cosmetic Act of 1938. The Federal Trade Commission has taken action against a number of these home diathermy concerns under this act, issuing "cease and desist" orders after due legal procedure. Members of this Congress are cooperating in furnishing advice and expert testimony to combat this and other forms of misleading advice and propaganda.

Light Therapy

In spite of the comparatively recent introduction of light therapy, quacks and borderline medicos were quick to capitalize on public interest and ignorance of the various forms of radiant energy. One of the announcements of George Starr White, M.D., and with many other titles, from Los Angeles, shows a person "sitting on a filteray cushion and receiving filtered ultraviolet rays while doing Rithmo-Chrome breathing and inhaling oxygen vapor of medicated vapor and at the same time getting therapeutic effects of the magnetic forces of the earth, as he is grounded and facing exactly north and south." And there exists a Col. Dinsah Ghadali, with another preposterous

"Spectro-Chrome Therapy," who sells a device with color filters in front of a powerful incandescent lamp and proclaims a topsy-turvy scheme of these color combinations to cure everything from tuberculosis to cancer. After dodging and fighting "cease and desist" orders and law suits by federal authorities for many years, he was finally convicted of fraud by a federal jury.

The overemphasis of the beneficial effects of the ultraviolet radiation led some fifteen years ago to extensive commercialization of ultraviolet transparent window glass. These glasses were advocated, not only for hospitals and convalescent homes, but also for offices, factories and schools, although it was evident that no benefit could be obtained unless everybody would don bathing trunks or similar undress and congregate next to the window under the noontime sun. While this artificial window glass craze died a natural death after a few years, another fad, the home use of artificial ultraviolet lamps, is still going strong. It seems regrettable that the barrier for advertising these lamps for lay use was ever let down.

Hydrotherapy

The Bavarian priest Father Kneipp was the first one to start a hydrotherapy fad when he advocated, some fifty years ago, walking barefooted in the dewy grass in the early morning. Whatever good this did it accomplished chiefly by getting the Victorian ladies out of bed early and making them exercise. "Hydropathy" was one of the chief selling points of the naturopaths on the continent of Europe. The fad of colonic irrigation, however, is chiefly an American product. It seems hard to believe that well informed medical men would go on advocating the constant risk of passing 10 feet of stiff tubing to wash out the intestinal tract when 2 feet of water pressure through a short tube would do the same. Today we hear no more about curing arthritis by colonic irrigation, and the number of colon laundry and intestinal flushing stations run by lay people is steadily diminishing.

Exercise and Massage

Exercise so far as the general medical profession is concerned has suffered rather by the lack of sufficient interest in its intelligent use. On the other hand, there can be no doubt that the commercially stimulated exercise "craze" by so-called physical culturists and self-styled experts holding forth in private gymnasiums or beauty establishments has done more harm than good. No special comment is needed on the gaudy and erotic type of exercise propaganda put out by the McFadden publications and those of the other "big muscle boys," as Fishbein aptly calls them. Many of these faddists advocate their own "system" of spring apparatus, dumbbell work, rubber band stretching and so forth — each one roundly denouncing the worthlessness of the other fellow's "system." The mass craze of taking morning exercises to the tune of the radio, evolved during the infancy of radio development, has fortunately passed away; but on beaches we can still see fat women wriggling desperately to carry on group exercise under the command of a muscular physical instructor.

Mechanical vibrators or other so-called mechanical exercisers, which are still being extensively advertised to the public, can do nothing that cannot be accomplished just as well with simpler apparatus or by voluntary exercise. At the same time severe injuries, rupture of the urinary bladder or of the appendix and hernias have been reported by physicians as actual results of popularly advertised exercise apparatus. In general, the use of all exercise apparatus is monotonous, and most persons soon tire of its use.

The use of massage has been also considerably overexploited in past years. Until massage became a recognized part of modern physical medicine,

there were a good many commercialized training schools in the United States which promoted the notion that it required no preliminary education and very little training to become a masseuse or masseur. "Swedish massage" made in the United States produced in many instances nothing better than bath house "rubbers"; in other cases certain too willing members of the female sex required the action of police departments to regulate their brand of massage. Commercialized "reducing parlors" in large metropolitan cities employ to this day lowly paid slaves to satisfy the stout ladies who hopefully crowd in in the false notion that vigorous rubbing by the hour will "break up the fat."

On the other hand, the many years' neglect by the medical profession to employ massage and manipulation in its proper place has been largely responsible for the growth of certain manipulative cults. It is just as objectionable for one physician to employ one piece of short wave apparatus in all his traumatic cases without any thought of proper massage and exercise as it is for another to tell his patients "go and get massage" without any specification as to technic. No properly trained physician should be hesitant to employ massage and manipulation himself to gain the advantage of palpatory skill and for moving the joints within an increasing range of motion.

The awakened national interest in physical fitness in connection with World War II has resulted in extensive clinical laboratory studies for tests and methods for a national program of physical fitness. This should do away with much of the haphazard and commercialized forms of general exercise. The entry of a large number of physical education graduates for reconditioning and occupational therapists for functional training has brought them near to the borderline of established therapeutic exercise. Such exercise must be administered by a technician trained in pathology and in the principles underlying the treatment of the sick and injured.

Comment

The misuses and fallacies enumerated as part of the evolution of physical medicine could be easily duplicated by enumeration of passing trends and fancies in all other departments of therapy. They could be also further extended by enumerating some physical treatment methods greatly extolled at one time or another for certain conditions and subsequently discarded because found wanting or being superseded by better methods. For instance uterine fibroids were treated at the end of the nineteenth century by destructive doses of galvanism applied by puncture through the vaginal wall; high blood pressure was claimed to be greatly benefited by autocondensation early in this century; a book was written on "diathermy in pneumonia" in 1923; for erysipelas ultraviolet radiation was claimed to be almost miraculous in 1930, and so on. Bacon once said, "Time is the greatest of innovators," but he also might have said, "the greatest of improvers." Physical medicine has been on the steady forward march for the past twenty-five years, but its final evolution is by no means complete. One should also bear in mind Pope's adage:

> "Be not the first by whom the new is tried,
> Nor yet the last to lay the old aside."

In its clinical application physical medicine requires the possession of sound basic information, an open but critical mind regarding newer methods and uses and constant careful observation of the established rules of technic. For the guidance of the practicing physician and his technicians, adherence to the following basic safeguards is recommended:

General Safeguards in the Practice of Physical Medicine. — 1. A diagnosis must be established; in addition, the extent of anatomic and functional changes to be combated has to be ascertained. One must not think in terms of using a piece of apparatus for the treatment of a diagnostic term, but rather the aim should be to influence the specified changes in an individual patient by general medical treatment combined with suitable physical agents. As a basis of treatment, establishment of a definite diagnosis by all known methods is essential. Remember that uncertain abdominal pain treated by diathermy has turned out to be due to cancer of the pancreas or chronic appendicitis and stubborn shooting pains along the leg resistant to galvanism have proved to be caused by a new growth in the spinal cord.

2. The physician must be familiar with the physical, physiologic and clinical effects of the various physical energies and their indications and contraindications. After selecting the form of energy and combination of energies, he must be able to give a prescription of the technic to be employed; however, since physical medicine is generally a reaction therapy, the physician must stand ready to modify the initial prescription to suit the individual.

3. While in our mechanical age apparatus has become almost indispensable, physical medicine must not necessarily be identified with apparatotherapy. The relative value of the various remedial agents must be always taken into consideration and simpler methods not neglected for complicated or spectacular ones. For instance, for many traumatic conditions luminous heat is just as effective as the more cumbersome and risky methods of diathermy; simple wet compresses and packs, hot local baths, applicable at home, can do a world of good by themselves, especially in the home.

4. Treatment must be applied according to the established rules with due care, safety and efficiency. Periodic check-up must be made as to the progress accomplished; treatment must be changed or discontinued when it is not fulfilling its object or is not further indicated. It is evident that any treatment by apparatus that is powerful enough to do good is capable of causing degrees of injury through improper technic, contributory negligence of the patient or mechanical faults. However, serious injury will never occur unless several rules of treatment are neglected at the same time. The paramount questions in any case of alleged malpractice will be always: "Was the treatment indicated and properly prescribed," and, "Did the patient receive treatment according to accepted rules of technic?" The physician is no guarantor of a perfect therapeutic result, but he is responsible at all times for the proper and safe technic of application by himself and his office aids.

As to new types of apparatus or new procedures of treatment, physicians should seek the advice of qualified specialists in physical medicine and in all doubtful instances of the Council on Physical Medicine of the American Medical Association or its Bureau of Investigation. Physicians not having received basic training in the employment of physical energies should avail themselves of the now freely offered facilities of postgraduate instructions and clinical observation in competently directed departments of physical medicine of hospitals and other teaching institutions.

2 East 88th Street.

Discussion

Dr. Walter M. Solomon (Cleveland, Ohio): Of the many papers or articles delivered at medical conventions, only a few possess poignant or stimulating ideas, fewer still can express axioms forcefully or judiciously and least of all are those that have any sparkling or redeeming wit. The paper Dr. Kovács has just delivered combines these and more. Of course, that is not unusual for him. Dr. Kovács always says something and that exceptionally well.

The fact that such abuses have afflicted physical medicine is not surprising, since a field such as this, more than the other branches of the profession is prone to ex-

ploitation. What is amazing is that more damage has not been done. A noticeable change in the prevalance and effect of these abuses has occurred since World War I and the credit belongs in no small measure to a relatively small group of men. Included in this group are such men as Coulter, Kovács and Krusen. To be sure other names should be added. You all know who they are. It is the work and investigation of these men during the past that has guided physical medicine away from many of the pitfalls. It has been their judgment and wisdom that has utilized the best of the various methods. Their efforts were not always appreciated by the unwary, or their purpose approved by the unscrupulous, but they persisted, with the result that physical medicine today enjoys recognition and respect.

Those of us who have entered physical medicine more recently fully realize our inheritance. For most of us these men were our teachers and our counselors, and, fortunately for us, today they still guide us wisely and help us. Not often have so few men influenced such a great number.

Therefore, to me this paper by Dr. Kovács is worthwhile not only because it presents facts in an interesting and entertaining manner, but indirectly demonstrates the power these men have exerted in a phase of physical medicine. Our debt to them is exceedingly great.

THE USE OF PHYSICAL THERAPY IN THE POSTOPERATIVE MANAGEMENT OF TENDON TRANSFERS AND GRAFTS IN THE HAND *

GEORGE S. PHALEN, M.D.

CLEVELAND

Physical therapy plays a very important role in the restoration of function in any crippled hand. This is especially true in those cases in which the surgeon has employed a tendon transfer or a tendon graft to restore or reinforce the power of flexion or extension of the fingers and wrist. The end result in cases of this type depends to some extent, of course, upon the type of operation performed upon the hand, but there are other factors which are equally and even more important.

One cannot expect a tendon transfer or a tendon graft to move a joint which cannot be passively moved prior to the operation. It is therefore imperative to mobilize all joints in the hand as much as possible prior to the operation. During the period of immobilization following surgical intervention the joints will stiffen to some extent, but they can readily be mobilized again.

Another factor which is of great importance in obtaining a good result from a tendon transfer or graft in a hand is the patient's intelligence and willingness to cooperate in his postoperative treatment. In patients who refuse to attempt any active movements of the transferred or transplanted tendons, either because of a low pain threshold or because of the absence of any desire to improve the function in their hands, the end results will always be poor, no matter how expertly the surgical procedures have been planned and executed. The end results are always better, too, when the patients are able to comprehend adequately the exact nature of the tendon transfer and the mechanics involved in its proper function.

The use of active splinting, as recommended by Bunnell,[1] has helped the physical therapist to mobilize stiffened joints as well as to maintain the strength and tone of unaffected muscle groups whose antagonists have been

* From the Cleveland Clinic.
* Read at the Twenty-Fifth Annual Session of the American Congress of Physical Medicine, Minneapolis, Sept. 4, 1947.

1. Bunnell, Sterling: Active Splinting of Hand, J. Bone & Joint Surg. 28:732, 1946.

paralyzed. In this type of splinting an elastic force is used to replace the function of the paralyzed muscle, but this force is not great enough to prevent normal opposing function of the unaffected muscles. This type of splinting may also be employed in many cases after tendon transfers.

It requires a period of approximately three weeks for adequate healing to take place across a tendon suture line. Immobilization of the hand for this period of time is advisable to prevent any disruption or strain of the line of suture. Some authors have advocated earlier mobilization, but the advantages gained by such a procedure are outweighed by the possible damage to the suture line which might be caused by a sudden twist or jerk. By the end of three weeks one may feel confident that the suture line is fairly strong, and less care will be necessary in the support of the hand after removal of the splint or cast. The splint applied after the operation should immobilize only those joints directly concerned with the tendon transfer or tendon graft. For example, the middle and distal interphalangeal joints of the fingers need not be immobilized in a tendon transfer for radial nerve paralysis, since the transferred muscles will be acting primarily on the proximal phalanges. The wrist and elbow joints must frequently be immobilized to maintain the necessary slack on a transferred tendon or a tendon graft. If these joints have no arthritis or internal derangement, a few weeks of immobilization will do no permanent harm.

In cases of tendon transfers, splinting must be continued until the patient is able to contract the transferred muscles. It is often advisable, too, to use a night splint for a week or two in order to prevent overstretching of the transferred muscles.

It is imperative that the physical therapist be well acquainted with the type of surgical procedure performed in every case of tendon transfer. If possible, the therapist should actually see some of these operations performed. When the therapist knows exactly what has been done in a particular tendon transfer, he is better able to explain the operation to the patient and to carry out an intelligent program of muscle reeducation. The origin, insertion and function of the transferred muscle may be described to the patient and shown to him on his opposite arm. The altered line of pull and the new insertion of the transferred muscle is then demonstrated to the patient. Occasionally it is necessary to employ electrical stimulation of the transferred muscle to give the patient the "feel" of the muscle pulling at its new insertion.

Radial Nerve Paralysis

Complete paralysis of the radial nerve causes a profound disability in the hand. A person with such a paralysis is no longer able to extend his wrist, extend his fingers at the metacarpophalangeal joints or extend and abduct his thumb. All the intrinsic musculature of the hand, as well as all the flexor muscles of the fingers and wrist, are still functioning, but the thumb cannot be brought out of the palm to enable the fingers to grasp. The inability to extend the wrist makes flexion power in the fingers very weak.

Fortunately, the tendon transfer usually employed in a complete radial nerve palsy is most effective in the restoration of almost normal function to the hand. The flexor carpi ulnaris tendon is severed at its attachment to the pisiform bone, rerouted subcutaneously on to the dorsum of the wrist and inserted into the extensor digitorum communis tendon. The flexor carpi radialis tendon is severed at the level of the wrist, withdrawn through a small incision in the lower third of the forearm, rerouted subcutaneously to the region of the anatomic snuffbox and inserted into the tendons of the abductor pollicis longus, extensor pollicis brevis and extensor pollicis longus muscles. The pronator teres tendon is detached from its insertion on the radius and

inserted into the adjacent tendons of the extensor carpi radialis longus and brevis. All these tendons are transferred under a moderate degree of tension, with the wrist and fingers held in complete extension (fig. 1).

After the usual three week period of immobilization, physical therapy is instituted. For the first week it is usually advisable to support the wrist in extension when the splint is removed, to prevent undue strain on the tendon suture lines, and some type of splint is worn to keep the wrist extended until active contraction of the transferred tendon can be demonstrated. With the removal of the splint, gravity aids in the release of extension contractures of the wrist and fingers. Radiant heat or the whirlpool bath may be followed by massage of the forearm and hand and gentle stretching of the metacarpophalangeal joints. There is usually little difficulty in teaching the patients to use the transferred muscles.

The pronator teres tendon transfer may be omitted in cases of complete radial paralysis, and the end result may be equally satisfactory. Activation of the two radial wrist extensor muscles does help, however, in the stabilization

Fig. 1. — A case of complete radial nerve paralysis, after a transfer of the flexor carpi ulnaris tendon into the extensor digitorum communis tendon and the flexor carpi radialis tendon into the tendons of the abductor pollicis longus and the extensor pollicis longus and brevis muscles. In the upper illustration the flexor carpi ulnaris tendon stands out on the dorsal aspect of the forearm. Extension of the fingers and wrist was excellent, and the patient was able to make a strong fist, as shown in the lower illustration.

of the wrist in extension. In cases in which the deep branch of the radial nerve alone is involved, the pronator teres transfer is not necessary because the extensor carpi radialis longus and brevis muscles are not paralyzed. In such a case, one of these muscles may be employed to activate the extensor pollicis longus, and the palmaris longus tendon may be transferred to the abductor pollicis longus and the extensor pollicis brevis tendons. This type of procedure leaves the flexor carpi radialis tendon undisturbed. It is advisable, if possible, to have one wrist flexor muscle functioning, even though it may be only the palmaris longus, because it aids in stabilization of the wrist.

The normal finger extensor muscles have an excursion of 2 inches, and

the normal wrist flexor muscles have an excursion of 1¼ inches. It is obvious, therefore, that a full range of wrist flexion cannot be restored after this tendon transfer. If the patient has from 45 to 60 degrees of active wrist extension and little or no flexion beyond a neutral position, the result is usually excellent. The physical therapist should not attempt to force the wrist into flexion beyond a neutral position but, rather, should stress active extension of the wrist and fingers with the transferred wrist flexor muscles. Flexion power in the wrist will always be weak, especially if both the flexor carpi ulnaris and flexor carpi radialis have been transferred; but flexion of the wrist is seldom, if ever, a forceful or purposeful movement. Because of the difference in excursion of the wrist flexors and the finger extensors, there is always a checkrein effect on the extensor muscles. The patient must extend his wrist to make a tight fist, and, by letting his wrist flex as far as possible, the finger will automatically be drawn into extension. The physical therapist must be on the watch for this checkrein action and must not be satisfied that the transferred tendons are functioning properly until there is active extension of the fingers and thumb with the wrist held in extension.

Median Nerve Paraylsis

In the hand, the median nerve is concerned primarily with opposition of the thumb. In some cases of median nerve paralysis there is still adequate opposition of the thumb, due either to ulnar innervation of the opponens muscle or to the action of the short flexor muscle of the thumb. Usually, however, loss of function in the opponens muscle of the thumb is a serious disability. In these cases, too, a tendon transfer is most effective in the restoration of almost normal function. In the usual type of transfer, the palmaris longus tendon is severed at the wrist, passed around the flexor carpi ulnaris tendon near its attachment to the pisiform bone, and prolonged by a free

Fig. 2. — Opponens transfer for median nerve paralysis. The extensor policis brevis tendon was severed at its musculotendinous junction, withdrawn at the base of the thumb and rerouted subcutaneously across the palm to the region of the pisiform bone, where it was attached to the palmaris longus tendon after the latter had been looped around the flexor carpi ulnaris tendon. Left, the thumb extended; right, the thumb opposed to the tip of the ring finger.

tendon graft passed subcutaneously across the palm to the dorso-ulnar aspect of the base of the proximal phalanx of the thumb (fig. 2). A pulley may be constructed at the pisiform bone by a tendon loop, and the flexor carpi ulnaris may be used instead of the palmaris longus as the activating muscle. The tendon of the extensor pollicis brevis muscle may also be employed instead of a free tendon graft, since its insertion is already in the proper position to

produce opposition of the thumb when traction is made in the direction of the pisiform bone.

In these cases it is well for the physical therapist to be acquainted with the exact type of operation which has been performed. Care must be taken not to abduct or extend the thumb forcibly for the first two or three weeks of physical therapy. The wearing of a splint to hold the thumb in opposition is frequently necessary for several weeks after the usual three week period of postoperative splinting. Since the tendon to the thumb passes subcutaneously across the palm, this tendon can be seen as well as felt to contract when the thumb is opposed to the fingers.

Median and Ulnar Nerve Paralysis

Paralysis of the ulnar nerve alone produces no very serious disability in the hand. Finely coordinated movements of the hand, of course, are impaired, and the strength of pinch between the thumb and index finger is lessened; but the disability is usually not severe enough to warrant tendon

Fig. 3. — Irreparable damage was done to all flexor muscles in the forearm. Flexion power has been restored to the fingers by transfer of the tendon of the extensor carpi radialis longus muscle into the tendons of the flexor digitorum profundus. At the left is shown the amount of flexion and at the right the amount of extension in the fingers six weeks after the tendon transfer.

transfers for restoration of the function of the adductor pollicis and the interosseus muscles. Furthermore, these tendon transfers are not as universally successful as those already described for median and radial nerve paralysis.

When both the median and ulnar nerves are severed at the level of the wrist, the hand is seriously crippled but the flexor tendons of the wrist are still available for transfer. However, when both the median and the ulnar nerve are involved at or proximal to the elbow, there no longer are any functioning flexor muscles in the forearm and the hand is perfectly useless. In these cases it is possible to motivate the flexors of the thumb and fingers by transfer of the tendons of the wrist extensors. The extensor carpi ulnaris tendon may be used to supply opposition to the thumb, and the extensor carpi radialis longus and brevis tendons may be transferred into the flexor pollicis longus and the flexor digitorum profundus. If all three extensor tendons are transferred, it will be necessary to establish arthrodesis of the wrist joint in about 25 degrees of extension. Since extension of the wrist and flexion of the fingers is an associated movement, muscle reeducation in patients who have had such a tendon transfer is relatively simple (fig. 3).

Flexor Tendon Grafts

Mobilization of the interphalangeal and the metacarpophalangeal joints is most important prior to the insertion of a flexor tendon graft. The line of tendon suture must lie distal to the distal interphalangeal joint and proximal to the distal palmar crease. This avoids the presence of a suture line within the digital sheath, since it is always in this region that adhesions readily form and restrict the movement of the tendon graft.

If a patient is able to touch the tip of the finger to the palm after a flexor tendon graft, this is considered an excellent result; one is seldom if ever able to clench the finger tightly into the palm. It usually requires at least two or three months of hard work by both the physical therapist and the patient before a good result can be expected from a flexor tendon graft. Active contraction of the grafted muscle is the only exercise worth while; resistive flexion exercises may be started after about the third week of physical therapy. It is important to stress flexion of the interphalangeal joints with the metacarpophalangeal joint fixed in a neutral position so that the flexion action of the lumbrical muscles is eliminated. A block of wood that fits into the palm and extends to the proximal interphalangeal joint effectively splints the metacarpophalangeal joint and aids the patient in mobilizing the flexor

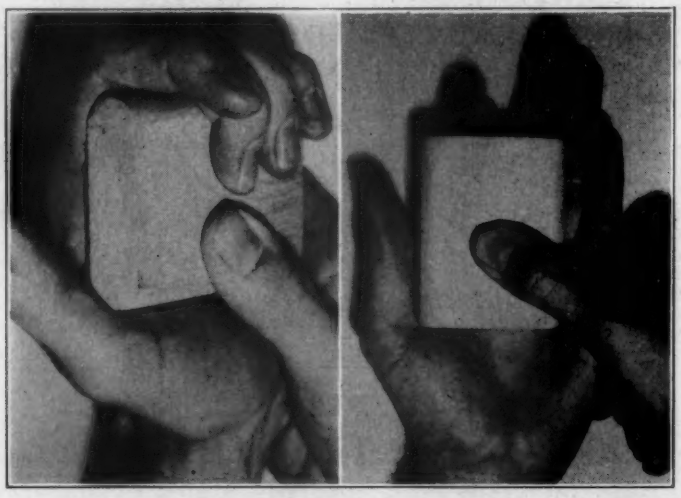

Fig. 4. — Use of a wooden palmar block aids in the mobilization of a flexor tendon graft within the digital sheath. At the left, the metacarpophalangeal joint is splinted in neutral position to eliminate the flexion action of the lumbrical muscles; at the right, both the metacarpophalangeal and the proximal interphalangeal joints of the finger are splinted to obtain flexion of the distal interphalangeal joint alone.

tendon graft within the digital sheath (fig. 4). This wooden block may be turned so that both the metacarpophalangeal and the proximal interphalangeal joints are splinted in neutral position, and the patient may then practice flexing the distal interphalangeal joint alone. With active resistive flexion exercise, it is often possible actually to hear adhesions break within the digital sheath.

Occupational Therapy

Occupational therapy is also an important adjunct in the postoperative treatment of tendon grafts and tendon transfers in the hand. Once the patient thoroughly understands what is expected of him, he can gain a great deal by actually using the crippled hand in a type of work directed toward stretching or contracting the involved tendons.

Discussion

Dr. Howard F. Polley (Rochester, Minnesota): It has been our good pleasure this afternoon to hear an orthopedist emphasize the effectiveness of physical therapy in the successful postoperative management of tendon transfers and grafts in the hand. Effective mobilization of muscles, tendons and joints constitutes one of the principal fields of usefulness in physical medicine. This is perhaps not better exemplified than in the case of the postoperative tendon transplants.

The close cooperation and mutual objectives of physiatrist and orthopedist are valuable assets in achieving the desired functional results. This is an especially pleasant and satisfactory relationship when the physiatrist has the benefit of an association with an orthopedist like Dr. Phalen who is familiar with the value of adequate and judicious use of physical medicine and who relies on physical treatment to complement his operative results.

Not only is the physiatrist helpful in supervising and directing the postoperative physical treatment but also he can be of considerable assistance in carefully evaluating muscle and nerve function preoperatively. Immobilization of the extremity or at least the region supplied by the nonfunctioning muscles has been present for some time prior to operation in many cases. In certain of these instances preoperative evaluation may properly include a trial of physical treatment including use of heat, massage, exercise and muscle reeducation. Dr. Phalen called our attention to the importance of obtaining maximal mobilization of joints of the hand before operative procedures are undertaken. In other instances tests for grading muscular function both manually and by use of electrodiagnostic devices that have been made available recently may be all that is indicated, but this can form the basis for a more accurate evaluation of postoperative progress as well as be a helpful factor in selection of the operative procedure to be performed. This aspect of the management of tendon transplants and grafts in the hand is beyond the subject of Dr. Phalen's presentation this afternoon. However, since realization of its importance is a relatively recent development and because of its importance from the physiatrist's point of view, I should like to ask Dr. Phalen if he would give us briefly his opinion regarding the value to him of preoperative consultation with, and possibly treatment of the patient by, the physiatrist.

Dr. George Wilson has called attention to a greater tendency for use of silk sutures to be followed by collection of serum or stitch abscess formation, regardless of the amount and type of physical therapy. I should like to ask Dr. Phalen if this has been his experience and if this is the chief reason for using other types of suture material.

The description and illustration of various types of tendon transfers have been very helpful to those of us who work with these patients in achieving a functional result but who do not have the frequent opportunity of visualizing the operative procedures involved.

Dr. Phalen is to be complimented on his instructive and concise presentation. He has admirably demonstrated an example of the advantages to be gained from mutual cooperation between orthopedist and physiatrist.

Dr. George Phalen (closing): I thank Dr. Polley for his kind remarks. I am sorry I did not have time to talk more about the preoperative care of these patients prior to tendon transfers. Some of these patients have to be followed for many, many months before even attempting to give them any type of operative repair, simply because their joints are so stiff that it is obvious the repair would not be effective.

It is absolutely necessary to mobilize joints in the hand and wrist as completely as possible prior to the tendon transfer if one expects good results. This may mean waiting several months before the operation, but they are months well spent.

During this period of time we have employed what we call active splinting, as so adequately described by Bunnell. This is a type of splinting that gives elastic replacement to the paralyzed muscles, but this elastic pull is not sufficiently great to prevent the normal opposing muscle from working satisfactorily. In other words, in a wrist a spring wire splint that will force the wrist up a little bit, but not hard enough so the flexors can't bring it down again, will give the patient mobility to the joints that he cannot get any other way.

As far as silk sutures are concerned, we do not use silk much any more, if at all, because it has been found to be more irritating and produces more foreign body reaction than does wire. However, if any wire sutures are left in situ, naturally one must be careful not to employ any type of diathermy in giving these patients heat.

We have followed Dr. Bunnell's method of the pull-out wire technic in as much of our suture work as possible in tendons, and in this type of suture all of the wire is withdrawn three weeks following the suture.

PHYSIOLOGY OF RESPIRATION

As Applied to the Treatment of Bulbar Poliomyelitis *

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and

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MINNEAPOLIS

Bulbar poliomyelitis presents a challenging problem to the physician and physiologist alike. The high mortality makes patients with the disease a critical problem for the physician. The involvement of the nervous centers for control of respiration and circulation as well as those centers controlling the skeletal muscles presents a complicated problem in clinical physiology. Respiratory exchange, adequacy of an airway, problems of pharyngeal and laryngeal secretions, blood pressure regulation and heart rate are involved. Since these are vital functions which must be maintained without interruption, early recognition and treatment of such lesions are of the greatest importance. Many lives can be saved by the early correction of the respiratory deficiencies encountered in this disease, whereas even slight delays in the institution of proper therapy may render the most heroic efforts futile.

The Abnormal Dynamics of Respiration Encountered in Bulbar Poliomyelitis

The successful application of the fundamentals of respiration to the treatment of poliomyelitis requires the appreciation and solution of at least three basic problems encountered in the course of the disease.

I. Inadequate pulmonary ventilation, due to
   - A. Intercostal and diaphragmatic paralysis brought about by cervical and thoracic cord involvement
   - B. Respiratory center paralysis with normal cervical and thoracic cord function
   - C. Obstruction of the upper airway due to laryngeal and pharyngeal paralysis and inability to clear secretions

II. Lung pathology
   - A. Reduction of gaseous exchange between blood and alveolar contents due to pulmonary edema and capillary hemorrhage
   - B. Atelectasis

III. Barriers to diffusion of gases between capillaries and nerve cells

Rationale of Oxygen Administration

During the acute phase of the disease, attention should be directed toward maintenance of normal function of the involved nerve cells, and every effort should be made to prevent further embarrassment of the diseased cells in order to minimize destruction of vital nerve tissue.

It is recognized that hypoxia quickly destroys neurons. It is possible that the cells already attacked by the poliomyelitis virus are even more susceptible to hypoxia. Therefore the aim of oxygen therapy should be to maintain an uninterrupted normal arterial oxygen tension of at least 100 mm. of mercury. An oxygen tension less than 100 mm. may impair the function of the vital centers.

It is important to call attention to some of the frequently disregarded physicochemical aspects of oxygen transport in the presence of the conditions

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* Read at the Twenty-Fifth Annual Session of the American Congress of Physical Medicine, Minneapolis, Sept. 5, 1947.

mentioned. The usual laboratory test in regard to oxygenation is the determination of the percentage oxygen saturation of the hemoglobin in the arterial blood.[1] This is a most useful adjunct, but it may also lead to erroneous conclusions as to the amount of oxygen reaching the cells. Examination of the hemoglobin saturation curve (chart 1) reveals that small decreases in percentage oxygen saturation of hemoglobin represent large changes in partial pressure of oxygen in solution in the plasma. In the final analysis, the difference in partial pressure of oxygen between plasma and the fluid surrounding the oxygen-consuming cell is one of the factors which determines the rate at which oxygen flows from plasma to cell. For example, if the percentage saturation of hemoglobin is reduced from the normal of 96 per cent to 90 per cent, the partial pressure of dissolved oxygen in the plasma falls from 100 to 60 mm. of mercury, which means a reduction of at least 40 per cent in the force which moves oxygen from plasma to cell (chart 1). Clinically, cyanosis has too frequently been regarded as the first sign of oxygen deficiency and as an indication that remedial therapy should only then be initiated. Unfortunately, cyanosis is seldom detectable if the saturation of hemoglobin is above 80 per cent. At a saturation of hemoglobin of 80 per cent, the partial pressure of oxygen has been reduced to only 45 mm. of mercury. In other words, when cyanosis is first visible the flow of oxygen from capillary blood plasma to nerve cell may be decreased by at least 65 per cent. This makes it obvious why the patients with bulbar poliomyelitis who become cyanotic most often succumb.

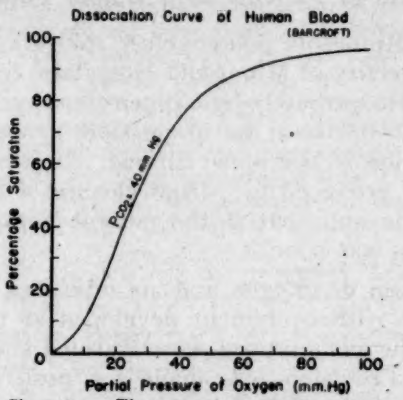

Chart 1. — The percentage oxygen saturation of hemoglobin in relation to the partial pressure of oxygen and altitude.

Another important consideration in the oxygen transport system is the condition of the immediate environment of the nerve cell receiving oxygen. Often in poliomyelitis, edema, perivascular infiltration, hemorrhage and debris increase the resistance to diffusion of oxygen from plasma to cell by the increased distance from capillary to cell, the physical obstruction by particulate matter and by the increased oxygen consumption by the infiltrating white cells.

At certain times an oxygen tension of more than the normal 100 mm. of mercury may be of great benefit in overcoming the resistance to movement of oxygen from plasma to cell. If the 570 mm. arterial nitrogen tension is substituted by oxygen, the total oxygen tension becomes approximately 670 mm. Hg.[2] This great increase in oxygen partial pressure increases the oxygen

1. Elam, J. O.; Hemingway, A.; Gullickson, G., and Visscher, M. B.: The Impairment of Pulmonary Function in Poliomyelitis, to be published.
2. Dripps, R. D., and Comroe, J. H.: The Effect of the Inhalation of High and Low Oxygen Concentrations on Respiration, Pulse Rate Ballistocardiogram and Arterial Oxygen Saturation (Oximeter) of Normal Individuals, Am. J. Physiol. 149:277, 1947.

carrying capacity of the blood by only 10 to 15 per cent[3]; however, the oxygen pressure gradient from capillary to cell is increased by approximately 600 per cent. Although this pressure rapidly diminishes as the blood passes along the capillary, the oxygen-consuming cell receives a substantial increase in its oxygen supply, which in many cases is the difference between life or death for the cell[4]

Treatment of Patients with Bulbar Poliomyelitis

During the 1946 Minnesota poliomyelitis epidemic, the routine treatment developed at the University of Minnesota Hospitals[5] consisted in prophylactic tracheotomy followed immediately by oxygen therapy. Prophylactic tracheoomy was performed to insure as far as possible against any episodes of hypoxia due to obstruction of the upper airway. It was noted that the initial symptoms of hypoxia produced by partial closure of the upper airway were often extremely subtle and that if the patient experienced an interval of cyanosis the prognosis was poor.

Oxygen and helium or oxygen and air mixtures were administered via the tracheotomy tube with equipment developed at the University of Minnesota Hospitals.[6] The gas mixtures were warmed and humidified before entering the trachea. Provision was made for positive pressure breathing. Additional oxygen was frequently administered by mask, in order to prevent dilution of the oxygen mixtures entering the tracheotomy tube by air inhaled through the upper air passage.

There is experimental evidence that long-continued inhalation of 100 per cent oxygen may produce pulmonary damage.[7] Under such conditions it is recommended that 50 per cent oxygen and 50 per cent helium or nitrogen mixtures be used, except when hypoxia persists in spite of the elevated oxygen intake. The rationale of helium administration has been presented by several investigators.[8]

Of utmost importance is the problem of the proper use of respirators. There is little or nothing to be gained by placing a patient with bulbar poliomyelitis with only airway obstruction in the respirator, since the difficulty is not eliminated and the respiratory, laryngeal and cardiac difficulties may only be increased. The force of the respirator may move secretions farther down the tracheobronchial tree, thus increasing the possibility of atelectasis and pneumonia. Artificial respiration is indicated only in cases of ventilatory deficiency[1] due to partial or complete paralysis of the diaphragm or intercostal muscles or to involvement of the respiratory center. If these conditions are combined with airway obstruction, tracheotomy should be performed immediately and the patient then placed in the respirator.

Symptoms of Hypoxia

The symptoms of hypoxia are often subtle and easily mistaken for other neurologic disorders. Some of the commoner effects of hypoxia are headache,

3. Boothby, W. M.; Mayo, C. W., and Lovelace, W. R.: One Hundred Per Cent Oxygen; Indications for Its Use and Methods of Its Administration, J. A. M. A. 113:477, 1939.
4. Footnote deleted on proof.
5. Minnesota Poliomyelitis Research Commission: Poliomyelitis: I. Bulbar Poliomyelitis. A Neurophysiological Interpretation of the Clinical and Pathological Findings. J. Nerv. & Ment. Dis., to be published. The Bulbar Form of Poliomyelitis: I. Diagnosis and the Correlation of Clinical with Physiological and Pathological Manifestations, J. A. M. A., to be published.
6. Kubicek, W. G.; Holt, G. W.; Elam, J. O.; Brown, J. R., and Gullickson, G.: Oxygen Therapy in Poliomyelitis: A Tracheotomy Inhalator, J. A. M. A., to be published.
7. Lavoisier, A. L.: Mémoires de médecine et de physique médicale. Soc. ray. de med. 5:569, 1938. Paine, J. R.; Keys, A., and Lynn, D.: Manifestations of Oxygen Poisoning in Dogs Confined in Atmospheres of 80 to 100 Per Cent Oxygen, Am. J. Physiol. 133:406, 1941.
8. Barach, A. L., and Eckman, M.: Use of Helium in the Treatment of Asthma and Obstructive Lesions, Ann. Int. Med. 9:739, 1945. Dean, R. B., and Visscher, M. B.: Kinetics of Lung Ventilation, Am. J. Physiol. 134:409, 1939.

irrational states, hyperpyrexia and tachycardia. Cullen and Skewis[9] stated that the most reliable sign of early oxygen want is an increased pulse rate. They reported that if oxygen is discontinued and the pulse rate increases the patient still requires excess oxygen. Likewise, hyperpyrexia may be due to depression of the temperature-regulating center by hypoxia and be relieved by adequate oxygenation. The following case demonstrates tachycardia and hyperpyrexia on the basis of hypoxia (chart 2):

A 17 year old boy had severe bulbar involvement upon admission to the University Hospitals. Because of laryngeal and pharyngeal paresis, tracheotomy was performed to provide an adequate airway. Immediately after the tracheotomy, large quantities of viscous fluid welled up through the tracheotomy tube. After approximately three hours' inhalation of 50 per cent oxygen and 50 per cent helium, the trachea became clear of fluid. Twelve hours after tracheotomy, the temperature had decreased from 104 to approximately 100.5 F. and the pulse rate dropped from an average of 120 to 100 per minute. The temperature and pulse remained at this level for six days and then gradually fell to normal. The patient was comatose for ten days and received only intravenous feeding for thirteen days. The rate of intravenous infusion was restricted to

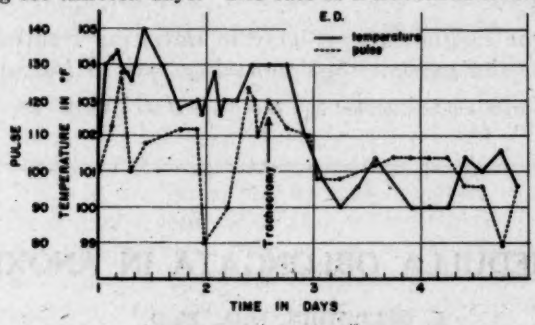

Chart 2. — A record of the temperature and pulse rate of a patient with bulbar poliomyelitis before and after tracheotomy.

a maximum of 200 cc. per hour to prevent lung edema by flooding of the cardiovascular system. On the fourteenth day, the patient began taking liquid food by mouth, and thirty days later he was discharged from the hospital with only a residual paresis of the soft palate and unilateral vocal cord paralysis.

Comment

This case, like several others, illustrates that tachycardia and hyperpyrexia are often the symptoms of hypoxia and can be relieved by proper oxygen therapy if applied before permanent damage has occurred. The usual and commendable technic of long and careful observation of symptoms and findings before the start of therapy will only lead to continuation of the high mortality rate in bulbar poliomyelitis. This type of patient presents a rapidly changing set of conditions in the acute phase of the disease. The fact that infection may spread only a few millimeters and thereby depress or completely abolish the function of a vital center makes the acute phase of the disease a dynamic and treacherous process. Superimposed upon the rapid and destructive effects of the poliomyelitis virus are the lethal effects of hypoxia, which occur in even shorter time than those of the virus. Perhaps the most difficult aspect of the problem confronting the physician responsible for the care of patients with bulbar poliomyelitis is the detection of hypoxia. Repeated observations indicate that if cyanosis is used as a criteria for initiating treatment for hypoxia the patient has little chance of survival because of the extensive damage to the nervous system produced by the greatly reduced flow of oxygen to the diseased nerve cells. Since the early symptoms of hypoxia are neither so dramatic nor so obvious as cyanosis, the physician must rely on the more sensitive indicators, such as the pulse

9. Cullen, S. C., and Skewis, J. E.: The Prophylactic and Therapeutic Use of Oxygen in the Surgical Patient, J. Iowa M. Soc., Oct., 1941.

rate, temperature and irrational states. Dripps and Comroe[2] reported that decreasing the oxygen content of the inspired gas mixtures by only 2 per cent (from 20 to 18 per cent) produced a significant elevation of pulse rate in 79 per cent of the normal men tested, whereas a slightly greater decrease in oxygen intake produced an increase in respiratory minute volume. It is important to determine whether or not hypoxia is the cause of any variations in temperature, pulse and respiration occurring in the course of bulbar poliomyelitis.

Summary

Some aspects of the physicochemical conditions of oxygen transport system encountered in bulbar poliomyelitis are presented.

If laryngeal and pharyngeal paresis are observed along with an elevated temperature and pulse rate, tracheotomy should be performed and oxygen therapy started immediately, in order to prevent hypoxia damage to already infected nerve cells.

Indecision in the diagnosis and delay in initiating treatment of hypoxia will fail to decrease the present high mortality rate of bulbar poliomyelitis.

The discussion of this paper will be published in a later issue of the ARCHIVES.

THE MEDULLA OBLONGATA IN ANOXIA *

E. GELLHORN, M.D., Ph.D.

MINNEAPOLIS

During the poliomyelitis epidemic of 1946, clinical, physiologic and pathologic investigations performed by Baker,[1] Kubicek[2] and their collaborators seemed to show that (1) in many cases of bulbar poliomyelitis the blood is not fully saturated with oxygen, as oximeter readings indicate; (2) a symptomatology develops suggesting damage to the respiratory or to the vasomotor centers, and (3) the administration of oxygen is beneficial in these cases. A review of the effects of anoxia on the respiratory and vasomotor centers in the medulla oblongata seems to be desirable for the proper evaluation of these observations.

I. The Relative Sensitivity of the Medulla Oblongata to Anoxia

Before the action of hypoxia on the respiratory and vasomotor apparatus is discussed, it is well to remind the reader that the medulla oblongata as a whole is much less sensitive to lack of oxygen than are the phylogenetically younger parts of the central nervous system (cerebral and cerebellar cortex). This is well established by numerous observations on man showing loss of consciousness occurring at a low barometric pressure when circulatory and respiratory functions are unimpaired. In experiments eliminating brain circulation completely, the damage is greater in the cortex and midbrain than in the medulla oblongata. Heymans showed on the isolated head that pupillary reflexes are abolished after a circulatory arrest of from fifteen to twenty

* From the Laboratory of Neurophysiology, University of Minnesota.
* Aided by a grant from the National Foundation for Infantile Paralysis, Inc.
* Read at the Twenty-Fifth Annual Session of the American Congress of Physical Medicine, Minneapolis, Sept. 5, 1947.

1. Baker, A. B.: To be published.
2. Kubicek, W. G.: To be published.

minutes, whereas respiratory activity could be restored even after a cessation of circulation of sixty minutes.[3]

The results of these in vivo experiments are paralleled by data obtained under in vitro conditions in which the oxygen consumption of the medulla was found to be definitely less than that of the cortex and basal ganglions.[4]

However, the marked difference in the sensitivity to hypoxia of the medulla oblongata as compared with that of the cortex does not seem to be based on quantitative differences in the metabolism of these structures alone. The fact that respiration may be noticeably increased in anoxia when cortical activity as measured by the electroencephalogram and sensory tests is decidedly depressed (Gellhorn and Hailman)[5] points to the fact that qualitative differences exist in the reactivity of the medulla and the supramedullary mechanisms. They are based upon the fact that the chemoreceptors of the sinoaortic region exert a profound excitatory action on the medullary centers but do not seem to display similar effects on the cortex.[6]

II. Acute Anoxia and Respiration

The discovery of the chemoreceptors by Heymans[7] and of their influence on the respiratory center in the medulla oblongata revolutionized the physiology of respiration. With respect to anoxia, it can now be stated that whereas inhalation of oxygen-nitrogen mixtures induces an increase in respiratory minute volume in the normal animal it causes a gradual respiratory paralysis after the chemoreceptors of the sinoaortic region have been eliminated. In hypoxia the activity of the respiratory center is maintained at an increased level through impulses originating in the chemoreceptors of the carotid sinus and of the arch of the aorta which impinge on the respiratory center. These impulses increase in frequency with increasing degree of hypoxia, as action potential studies of the carotid sinus nerve demonstrate (von Euler, Liljestrand, Zotterman).[8] The great sensitvity of this peripheral mechanism is attested, furthermore, by the fact that such chemoreceptor impulses could be recorded when the oxygen saturation of the blood fell to less than 96 per cent. Elimination of pressoreceptors does not modify the response to anoxia (Bouckaert, and Pannier).[9] If the medullary centers are depressed, as in barbiturate anesthesia, respiration may be maintained solely through anoxic stimulation of the chemoreceptors. In such cases, administration of 100 per cent oxygen may lead to respiratory failure by eliminating excitatory impulses from these receptors.[10]

III. Acute Anoxia and the Vasomotor Center

The conclusion drawn from the preceding section, that anoxia stimulates the respiratory center via impulses originating in the peripheral chemoreceptors whereas it paralyzes the center directly, is applicable to the vasomotor apparatus. In the normal anesthetized dog, anoxia increases the blood pressure slightly, and this effect is more pronounced if the respiratory volume is kept constant by application of artificial respiration in an animal with pneumothorax. If the carotid sinus is denervated bilaterally, the normal blood pressure response is still maintained provided that respiration is kept con-

3. For further literature, see Gellhorn, E.: Autonomic Regulations, New York, Interscience Publishers, 1943. Kabat, H.; Dennis, C., and Baker, A. B.: Am. J. Physiol. 132:737, 1941. Rosen, R.; Kabat, H., and Anderson, J. P.: Arch. Neurol. & Psychiat. 50:510, 1943.
4. Craig, F. N., and Beecher, H. K.: J. Neurophysiol. 6:135, 1943. Chesler, A., and Himwich, H. E.: Am. J. Physiol. 141:513, 1944.
5. Gellhorn, E., and Hailman, H.: Psychosomat. Med. 6:23, 1944.
6. The action of the chemoreceptors on the cortex is being investigated at the present time in this laboratory.
7. Heymans, C.; Bouckaert, J. J., and Régniers, P.: Le sinue carotidien, Paris, 1933.
8. Euler, U. S.; Liljestrand, G., and Zotterman, Y.: Skandinav. Arch. f. Physiol. 83:132, 1939.
9. Bouckaert, J. J., and Pannier, R.: Arch. internat. pharmacodyn. 67:343, 1952.
10. Marshall, E. K., Jr., and Rosenfeld, M.: J. Pharmacol. and Exper. Therap. 57:137, 1936.

stant by artificial means. However, in such a dog without artificial respiration, anoxia induces a very profound fall in blood pressure as a result of respiratory failure. The latter is to be expected, since the most important peripheral chemoreceptors which are responsible for the maintainance of respiration in anoxia are located in the carotid bodies.

The vasomotor center causes the maintainance of blood pressure and the pressor response ordinarily seen in normal animals in anoxia through chemoreceptor impulses. This is shown by the fact that the complete elimination of all chemoreceptors by bilateral vagotomy and denervation of the carotid sinus leads to a fall in blood pressure during anoxia. If three of the four chemoreceptors are destroyed, the normal blood pressure rise occurring in anoxia is maintained under conditions of artificial respiration. By the application of cold block to the remaining intact nerve which normally conveys chemoreceptor impulses to the vasomotor center, the normal pressor response to anoxia can be changed into a depressor response (vasomotor failure.[11])

It may therefore be concluded that the respiratory and the vasomotor centers react to anoxia with an increased activity as long as these centers are under the influence of impulses originating in the chemoreceptors. If the latter are removed, the medullary centers show a decline in activity and ultimate failure, just as other parts of the central nervous system.[12]

IV. The Function of Medullary Centers in Chronic Anoxia

If the experiments performed on various laboratory animals were applicable to the conditions of human bulbar poliomyelitis, in which some mild degree of anoxia is present, one would infer that the normal mechanism by which anoxia is compensated (increased respiratory volume and increased blood pressure) is deficient. In the light of the previous discussion, respiratory and circulatory failure observed in cases of bulbar poliomyelitis must be attributed to an inadequate response of the medullary center to chemoreceptor impulses. It seems to be unlikely that a disease such as infantile paralysis, which acts primarily on central structures, would interfere with the excitation of the chemoreceptors to anoxemia, and it appears more probable that the responsiveness of the diseased medullary neurons to these afferent impulses is diminished or lost. Consequently, under these pathological conditions, in which a relatively mild degree of anoxia develops, one may see, not the increased responses of respiratory and vasomotor centers which characterize the physiologic reactivity of these structures to excitatory impulses of the sinoaortic receptors, but a progressively diminished reactivity of the vegetative medullary centers. The diseased medullary neurons react to anoxia somewhat as do medullary neurons deprived of the impulses originating in the chemoreceptors. In addition, it may be assumed that even a mild degree of anoxia is damaging to the diseased neurons in the medulla.

However, another interpretation requires serious consideration. The experiments previously described refer to the condition of acute anoxia persisting for minutes only and do not take into consideration the possibility that with persistance of the anoxia for longer periods other mechanisms may be called into action. This assumption seems to be justified, since Bjurstedt[13] showed recently that, whereas in acute anoxia respiratory hyperventilation depends solely on the chemoreceptor drive, the increased respiration in chronic anoxia seems to be independent of chemoreceptor impulses and due to an increased activity of the respiratory center itself. This conclusion is based

11. Gellhorn, E., and Lambert, E. H.: The Vasomotor System in Anoxia and Asphyxia, Urbana, Ill., The University of Illinois Press, 1939.
12. See also Bouckaert, J. J.; Grimson, K. S.; Heymans, C., and Samaan, A.: Arch. internat. pharmacodyn. 65:63, 1941.
13. Bjurstedt, A. G. H.: Acta physiol. Scandinav. 12: Supp. 38, 1946.

on the fact that in acute anoxia the blocking of the nerve impulses from the chemoreceptors of the carotid sinus area leads to an apnea, whereas in chronic anoxia hyperventilation persists more or less unchanged during the temporary withdrawal of chemoreceptor impulses by nerve block. It is further supported by Bjurstedt's observation that inhalation of room air following anoxia has not the same effect in acute and in chronic anoxia. In the former condition, this procedure may lead to a decrease in respiratory volume and further decrease in the oxygen saturation of the arterial blood, since the chemoreceptor control of breathing is eliminated, whereas in the latter condition the oxygen saturation curve of the blood rises smoothly as a result of the inhalation of air. These observations suggest that the maintainance of respiratory activity in chronic anoxia depends pirmarily on the respiratory center itself, whereas respiratory activity is controlled by chemoreceptors under conditions of acute anoxia. In view of the similar behavior of respiratory and vasomotor centers in acute anoxia, it may be suggested that the maintainance of blood pressure in chronic anoxia is likewise more dependent on the center than on the peripheral chemoreceptors. However, it should be emphasized that the effect of chronic anoxia on the reactivity of the vasomotor center has not yet been investigated. Until this gap in knowledge is filled, the interpretation which is offered here must be considered to be tentative only.

Summary

Physiologic studies on the effect of anoxia on the respiratory and circulatory system have shown that in acute conditions anoxemic stimulation of the chemoreceptors of the sinoaortic region results in an increased respiratory volume and increased blood pressure. Elimination of the chemoreceptors causes respiratory and vasomotor failure under conditions of acute anoxia. Data in the physiologic literature suggest that in chronic anoxia respiration and possibly blood pressure are regulated through the medullary centers alone. These data make it understandable that even mild degrees of chronic anoxia may have fatal effects if they act on diseased medullary neurons. This seems to the physiologic rationale for the oxygen therapy in bulbar poliomyelitis.

The discussion of this paper will be published in a later issue of the ARCHIVES.

ELECTROMYOGRAPHIC STUDIES OF PARALYZED AND PARETIC MUSCLES IN ANTERIOR POLIOMYELITIS *

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LOS ANGELES

Introduction

Electromyography has emerged partially from the laboratory to take its place as a recognized clinical procedure for the diagnosis and prognosis of various disorders of the neuromuscular system. During the past few years electromyographic studies have been made of patients with anterior poliomyelitis. Hansson and co-workers,[1] using percutaneous electrodes, investigated the motor unit activity of "polio" muscles having different grades of muscle power. Their data indicated that electromyograms provide definite characteristics of normal muscles as well as subnormal muscles with grades of "good," "fair," "poor," "trace" and "zero." Although numerous investigators have recorded fibrillation voltages from "polio" muscles (Denny-Brown and Pennybacker,[2] Watkins[3] and Jasper[4]), we have been unable to find any account in the literature in which this type of electrical activity in "polio" muscles has been correlated with muscle power as graded by the Lovett system. There has been uniform agreement among the workers in this field, however, that the needle electrode and cathode ray oscilloscope are essential for the recording of fibrillation voltages in denervated muscles. Weddell and associates[5] called attention to the fact that the motor unit voltages associated with beginning motor unit recovery in peripheral nerve injuries are usually of complex wave form. They designated this type of motor unit voltage as "nascent" or "new born" in their original publication; however, they pointed out subsequently[6] that the term "nascent" was inaccurate, because they believed it was theoretically possible for similar voltages to occur during the course of demyelinating diseases. Again, we have been unable to find any correlation of complex motor unit voltages in "polio" muscles with their respective muscle grades.

Because it was felt that the presence or absence of denervation fibrillation and complex motor unit voltages might have prognostic significance in anterior poliomyelitis as well as in peripheral nerve injuries, the present investigation was undertaken.

* Aided by a grant from the National Foundation for Infantile Paralysis, Inc.
gastrocnemius-soleus muscles, in which the proximal, middle and distal portions were sampled.

* Read at the Twenty-Fifth Annual Session of the American Congress of Physical Medicine, Minneapolis, Sept. 5, 1947.

1. Hansson, K. G.; Troedsson, B. S., and Schwarzkopf, E.: Arch. Phys. Med. 23:261, 1942.
2. Denny-Brown, D., and Pennybacker, J. B.: Brain 61:311, 1938.
3. Watkins, Arthur L.: Journal-Lancet 64:233, 1944.
4. Jasper, H. H.: Personal communication to the authors.
5. Weddell, G.; Feinstein, B., and Pattle, R. E.: Lancet 1:236, 1943.
6. Weddell, G.; Feinstein, B., and Pattle, R. E.: Brain, 67:178, 1944.

Materia[1] and Methods

The material consisted of 20 cases of confirmed anterior poliomyelitis. In these cases electromyographic examinations and clinical evaluations of the muscle power were made at regular intervals from the twenty-first to three hundred and sixtieth days after onset. Repeated examinations were made on a total of 330 paralyzed and paretic "polio" muscles; 95 per cent of these were muscles of the lower leg, and the remaining 5 per cent were thigh muscles. At each examination at least two areas of each muscle (proximal and distal) were sampled, with the exception of the anterior tibial and gastrocnemius-soleus muscles, in which the proximal, middle and distal portions were sampled.

The electromyograph used for this investigation was of the type described by Jasper and Johnston.[7] It consisted of a preamplifier, power amplifier, cathode ray oscilloscope and loud speaker (fig. 1). Electromyograms were obtained by photographing tracings on the oscilloscope. With use of the monopolar steel needle electrode technic, the following types of electrical activity in paralyzed and paretic muscles of patients with anterior poliomyelitis were found.

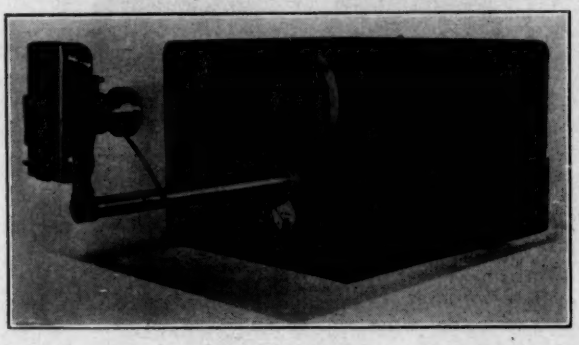

Fig. 1. — Electromyograph, consisting of amplifiers, cathode ray tube, loud speaker and camera. Panel shows control dials for operation of the various units of the electromyograph.

1. *Normal Motor Unit Voltages.* — Under voluntary effort these voltages may be elicited from normal and paretic muscles of "polio" patients. They are usually diphasic in character and may be observed or recorded as simple waves which range in magnitude from about 500 to 2,000 microvolts. The duration of a single diphasic wave is in the order of 5 to 10 milliseconds, and the repetition frequency varies from about 5 to 30 per second. These normal motor unit voltages are readily obtained from most areas in "polio" muscles having a muscle grade of "fair" or better. Because of the long duration of a single motor unit voltage, a characteristic low-pitched, thumping noise is produced in the loud speaker.

2. *Complex Motor Unit Voltages.* — These voltages have been recorded in some areas of the "polio" muscles graded as "trace" or better. The waves of such complex voltages range in magnitude from about 20 to 1,200 microvolts. The repetition frequency varies from about 2 to 30 per second, and the duration of a single wave group is usually in the order of 5 to 15 milliseconds. Complex motor units voltages give rise to characteristic harsh, low-pitched noises in the loud speaker.

3. *Fibrillation Voltages.* — These voltages, indicative of denervated muscle fibers, have been recorded from some areas in most "polio" muscles having a grade of "fair" or poorer. These voltage waves range in magnitude from about 10 to 100 microvolts, and their repetition frequency varies from about 2 to 30 per second. A single wave has a duration of approximately 1 to 2 milliseconds and, because of its extremely short duration, produces a characteristic "clicking" noise in the loud speaker. Examples of the various types of electrical activity recorded by eletromyographic examination of normal and paretic muscles are shown in figure 2.

Results

Table 1 shows the percentage of "polio" muscles having fibrillation in each grade ranging from "zero" to "good," inclusive, for designated time intervals after the onset of anterior poliomyelitis. A consideration of these

7. Jasper, H. H., and Johnston, R. H.: Report No. 10 to Associate Committee on Army Medical Research, National Research Council, Canada, from the Montreal Neurological Institute, McGill University, 1945.

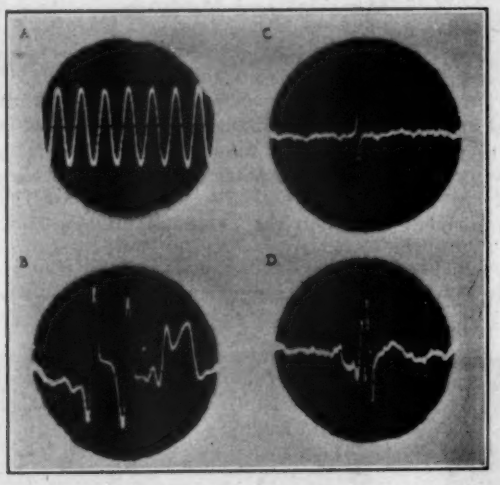

Fig. 2. — Typical oscillograms recorded from the screen of the cathode ray tube of the electromyograph. *B*, myogram; normal unit voltage; 1,700 microvolts peak to peak. *C*, myogram; fibrillation voltage; 30 microvolts peak to peak. *D*, myogram; nascent unit voltage; 130 microvolts peak to peak.

TABLE 1. — *Percentage of "Polio" Muscles Exhibiting Fibrillation Voltages at Designated Time Intervals in Muscle Grades Ranging from "Zero" to "Good," Inclusive*

Muscle Grade (Lovett)	Days After Onset (21-90)	(90-180)	(180-360)
	%	%	%
O	96	94	87
T	83	78	82
P	61	92	76
F	67	88	64
G	31	44	53

data reveals denervation fibrillation to be an inverse function of the muscle grade for all time intervals after the onset. Of particular interest, however, is the fact that fibrillation voltages were elicited from such a high percentage of "good" muscles. It should be noted also that fibrillation voltages were elicited from a higher percentage of the "good" and "poor" muscles 180 to 360 days after onset than was the case 21 to 90 days after onset. The "zero" group was the only one which showed a significant decrease in the percentage of muscles fibrillating 180 to 360 days after onset.

In table 2 the percentages of "polio" muscles having motor unit activity at designated time intervals after onset have been tabulated for the various muscle grades. Reference to this table shows that discreet motor unit activity could be elicited from a fairly high percentage of "zero" muscles and that those graded as "trace" showed only a slightly greater percentage of motor unit activity (6 per cent at 21 to 90 days and 27 per cent at 180 to 360 days). Discreet motor unit activity was not elicited in a high percentage of the areas sampled (27 to 41 per cent). Experience has demonstrated emphatically the extremely spotty distribution of motor unit activity in paretic muscles, especially those graded as "trace." This feature illustrates clearly the necessity for thorough sampling of the muscles if one expects to find motor unit activity other than baseline disturbances. The baseline disturbance (indicative of motor unit activity some distances from the needle electrode) ranged from 20 to 26 per cent in the "zero" muscles during the observation period and from 65 to 36 per cent (the percentage decreasing with

time) for the "trace" muscles. In the "poor" muscles the baseline disturbance decreased from 11 to 6 per cent and was absent entirely from muscles of higher grades.

TABLE 2. — *Percentage of "Polio" Muscles Exhibiting Discrete Motor Unit Activity and Baseline Disturbances at Designated Time Intervals in Muscle Grades Ranging from "Zero" to "Good," Inclusive*

Muscle Grade (Lovett)	Motor Unit Activity					
	Days After Onset					
	(21-90)		(90-180)		(180-360)	
	BLD	DMU	BLD	DMU	BLD	DMU
	%	%	%	%	%	%
O	20	28	26	30	25	32
T	65	33	55	44	36	59
P	11	89	0	100	6	94
F	0	100	0	100	0	100
G	0	100	0	100	0	100

BLD, baseline disturbance; DMU, discrete motor unit activity.

The percentage of "polio" muscles with complex "nascent" motor unit voltages is shown in table 3. Of particular interest is the fact that a rather high percentage of these complex motor unit voltages was elicited from mus-

TABLE 3. — *Percentage of "Polio" Muscles Exhibiting Complex Motor Unit Activity at Designated Time Intervals in Muscle Grades Ranging from "Zero to "Good," Inclusive*

Muscle Grade (Lovett)	Days After Onset		
	(21-90)	(90-180)	(180-360)
	%	%	%
O	48	86	60
T	75	100	70
P	50	100	94
F	79	93	90
G	81	67	82

cles of all grades 21 to 90 days after the onset. In addition, no significant decrease was noted in the percentage of muscles of all groups having complex forms 180 to 360 days after the onset.

TABLE 4. — *Total Number of Muscles Studied and Total Number of Areas Sampled; Percentage of Areas of "Polio" Muscles Exhibiting Fibrillation Voltages and Motor Unit Activity in Muscles of Grades Ranging from "Zero" to "Good," Inclusive.*

Muscle Grade (Lovett)	Muscles, No.	Areas, No.	Fibrillation	Motor Units	Complex Motor
			%	%	%
O	122	260	87	19	52
T	38	84	84	44	56
P	48	106	77	82	92
F	52	120	67	100	77
G	69	147	43	100	70

The data compiled and tabulated in table 4 correlate the electrical activity of "polio" muscles with the total number of areas sampled. A consideration of this table shows denervation fibrillation to be present in most areas (87 per cent) of the "zero" muscles, and in fewer areas (43 per cent) of the "good" muscles. Motor unit voltages are present in only a few areas (19 per cent) of the "zero" muscles and in all areas (100 per cent) of the "good"

muscles. Again the low percentage of areas in the "zero" (19 per cent) and "trace" (44 per cent) muscles having motor unit activity indicates the extreme spottiness of motor unit activity and the necessity for thorough sampling of such muscles.

In our series of cases it was possible to study the electrical activity of "polio" muscles of 9 patients over a period of 9 to 12 months. The electromyographic findings were correlated with the muscle grades at the beginning and at the end of the observation period. Initial electromyographic examinations were made between the twenty-first and fortieth postonset days and subsequently at intervals of 30 to 60 days up to the two hundred and seventieth and three hundred and sixtieth postonset days. A thorough sampling of the paretic and paralyzed muscles between the twenty-first and fortieth postonset days revealed the widespread presence of denervation fibrillation throughout their entire lengths. Similarly, the repeat examination on these same muscles, 270 to 360 days after onset, again revealed widespread fibrillation throughout their lengths. At the initial examination 54.2 per cent of these fibrillating muscles had, and 45.8 per cent did not have, motor unit activity. Subsequent examinations of the group of muscles which had both denervation fibrillation and motor unit activity at the initial examination showed an average power increase of three-fourths of a muscle grade in 38.4 per cent, no change in power in 46.2 per cent and an average decrease in power of three-fourths of a muscle grade in 13.4 per cent when examined 9 to 12 months after onset. Of the group of muscles, therefore, having widespread fibrillation and motor unit activity between the twenty-first and fortieth postonset days, only 38.4 per cent showed a significant increase in power when examined between the two hundred and seventieth and three hundred and sixtieth postonset days, whereas 61.6 per cent of them either remained the same or showed a significant decrease in power at the latter date. Of the muscles having extensive fibrillation and no motor unit activity at the initial examination, subsequent examinations 270 to 360 days after onset revealed an average power increase three-fourths of a muscle grade in only 18.2 per cent, whereas 81.2 per cent showed no change in their power rating at the time of the last examination.

Comment

In the present investigation fibrillation voltages have been recorded from a high percentage of paralyzed and paretic "polio" muscles 21 to 360 days after onset. In general, it may be said that there was an inverse relationship between the percentage of muscles having fibrillation and the magnitude of muscle power. A similar inverse relationship was found between the fibrillation and muscle power when expressed as percentage of areas showing fibrillation for the different muscle grades. Stated somewhat differently, fibrillation voltages were recorded not only in greater number of muscles with low muscle grades but also from a greater number of areas in the muscles with the lower grades.

It was shown that between the twenty-first and ninetieth postonset days the percentage of muscles having fibrillation in grades of "trace" or better did not show a significant decrease when examined six to twelve months later. Weddell and co-workers and Jasper investigated the onset and course of denervation fibrillation in patients with peripheral nerve injuries. They consistently found a significant decrease in the amount of denervation fibrillation when a denervated muscle became reinnervated. As with denervated muscles resulting from peripheral nerve injuries, so with denervated muscles resulting from anterior poliomyelitis; one would expect a significant decrease in the

amount of denervation fibrillation in the involved muscles if reinnervation took place. In addition, one would expect reinnervation of "polio" muscles to take place 9 to 12 months after the onset of the disease if the rate of axon regeneration were comparable to that following peripheral nerve injuries. Whether or not these denervated "polio" muscles will at some future date show signs of reinnervation, we cannot say at this time. From the evidence at hand, however, it appears that when sufficient damage has been inflicted on the cell of a motor unit to produce denervation fibrillation in its dependent group of muscle fibers, this cell is not capable of regenerating another axon to these muscle fibers; in other words, when the changes in an anterior horn cell have been sufficient to produce wallerian degeneration in the axon, these changes in the cell appear to be irreversible.

In the present investigation complex motor unit voltages have been recorded from a high percentage of paretic "polio" muscles 21 to 90 days after the onset. Although it seems unlikely that their presence in these muscles so early after the onset of the disease could represent reinnervation, we do not have any histologic proof that they did not result from a regeneration of the axons. From the evidence presented, however, one may presuppose that the presence of complex motor unit voltages in "polio" muscles 21 to 90 days after the onset represents nerve degeneration instead of nerve regeneration. This is in agreement with the suggestion of Weddell and co-workers, that complex motor units ("nascent") might be associated with demyelinating diseases.

As stated previously, the motor unit voltages associated with motor unit recovery in peripheral nerve lesions are usually of complex ("nascent") wave form. As functional recovery improves, however, there is a significant decrease in the number of complex forms and a significant increase in the number of simple or normal forms. One might logically expect, therefore, a decrease in the percentage of "polio" muscles having complex forms 180 to 360 days after the onset. In this investigation we were unable to find any significant decrease in the percentage of muscles having complex motor unit activity at this time. On the other hand, we did find a significant increase in the percentage of "zero," "poor" and "fair" muscles exhibiting complex forms 180 to 360 days after onset. From these data one may presume that the partially damaged motor neurons are very slow in regaining their normal state.

Of some interest was the distribution of motor unit activity in the muscles of various grades — in particular, in those of the "zero" and "trace" groups. In these two groups, discrete motor unit voltages could be elicited in only 19 per cent of the muscles and in 44 per cent of the areas sampled, respectively. Furthermore, it should be pointed out that it is not uncommon to elicit discrete motor unit activity in just one area (proximal, middle or distal) of these "zero" and "trace" muscles and that the discrete motor unit activity may be found just as frequently in the proximal as in the distal and, similarly, just as often in the middle as in the proximal and in the distal areas of these muscles will gain power in the next four years, we cannot say at this activity may be found just as frequently in the proximal as in the distal and, ough sampling is made throughout the length of a given muscle.

While we have been unable to follow cases of poliomyelitis in which the muscles did not exhibit denervation fibrillation throughout their lengths 21 to 40 days after onset, we believe the findings to be of prognostic significance in those muscles which did show fibrillation. In no instance did such fibrillating "polio" muscles show an increase in power exceeding one muscle grade nine months to one year after the onset, irrespective of the initial grade.

It should be emphasized that a much higher percentage of these muscles showed either no change in power or an actual decrease in power of one muscle grade nine months to one year after onset. Whether or not some of these muscles will gain power in the next four years, we cannot say at this time, although the work of Nelson[8] would indicate that continued improvement might be expected in a fairly high percentage of them during that time interval. However this may be, one may adduce from the evidence presented that the presence of widespread denervation fibrillation in paretic and paralyzed "polio" muscles 21 to 40 days after the onset pressages an incomplete functional recovery.

Summary and Conclusions

1. Fibrillation voltages were recorded from a high percentage of paralyzed and paretic "polio" muscles 21 to 360 days after onset.
2. Fibrillation voltages were recorded not only in a greater number of muscles with low muscle grades but also from a greater number of areas in the muscles with the lower grades.
3. With the exception of "zero" and "fair" muscles, fibrillation voltages were recorded from as many of the remaining muscles 180 to 360 days after onset as was the case 21 to 90 days after onset.
4. Motor unit voltages were recorded not only in a greater number of muscles with high muscle grades but also from a greater number of areas in muscles with the higher grades.
5. Complex motor unit voltages were recorded from a high percentage of paretic "polio" muscles 21 to 360 days after onset. Forty-eight to 81 per cent of the muscles showed complex motor units 21 to 90 days after the onset of acute anterior poliomyelitis, suggesting that this abnormal type of motor unit activity may be associated with degenerative processes of motor neurons.
6. With the exception of the "trace" group, complex motor units were obtained from as many or more of the remaining muscles 180 to 360 days after onset as was the case 21 to 90 days after the onset.
7. The motor unit activity in "zero" and "trace" muscles was extremely spotty and was found just as frequently in the proximal as in the distal portion of the muscles.
8. Complete functional recovery has not been observed to date in those muscles which had denervation fibrillation throughout their lengths 21 to 40 days after onset.
9. Electromyographic examination of paralytic and paretic "polio" muscles supplies additional data of diagnostic and prognostic significance.

8. Nelson, Norman: Arch. Phys. Med. 28:358, 1947.

The discussion of this paper will be published in a later issue of the ARCHIVES.

EVALUATION OF TRAINING OF PHYSICAL EDUCATIONISTS FOR RECONDITIONING AND REHABILITATION *

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Physical medicine has a definite interest in the training of physical educationists in the colleges and universities of this country. This interest is not new, as men and women from the field of physical education have been accepted for courses in the technic of physical therapy by accredited schools of physical therapy for more than twenty years. Today, however, something new has been added.

The great influx of physical educationists into the field of physical reconditioning in the Army, Navy and Army Air Force convalescent programs during the war, the utilization of such personnel in Army and Veterans Administration hospitals since the war and the separate recognition accorded physical reconditioning by the Baruch Committee in its recommendations for the establishment of rehabilitation centers, amply justify the concern of physical medicine in the training of personnel entering this work. It is, therefore, appropriate to request a searching investigation of the training standards in physical education. The question may logically be asked, Should persons trained in physical education be accepted as technicians in physical reconditioning as used in medical practice?

This paper should be considered as an introductory exploration and a preliminary evaluation of the training of physical educationists for work in reconditioning and rehabilitation. No effort was made to be exhaustive in considering this subject. References to past and recent studies pertaining to this problem, however, have been made, and some new material has been included.

Influences Affecting Physical Education

In considering the appropriateness of training in any field, whether it is engineering, medicine or physical education, it is necessary to understand the purposes to be achieved by that training. Certainly, training for the three professions mentioned would not be identical, as the purposes to be achieved are not identical. Therefore, to evaluate intelligently the training of physical educators, one must first understand the development of this field, the influences that have affected it and the adjustments made to these new influences as they have appeared. Very sketchily, then, the following key factors in the growth of physical education in this country are presented.

1. Early forms of physical education were transplanted from European countries by immigrants. Two major systems of this sort, the German and the Swedish, have had a lasting effect. The German form, based upon gymnastics and the use of heavy apparatus, arrived early, around 1825. Based upon "medical gymnastics," the Swedish system was introduced in the late

* Read at the Twenty-Fifth Annual Session of the American Congress of Physical Medicine, Minneapolis, Sept. 3, 1947.

1880's. These forms, along with a smattering of other European systems, still are utilized somewhat in physical education programs in the United States.[1]

2. In the early days of physical education, physical development — the building of strong and enduring bodies — was the primary, and perhaps only, concern of the physical educator. Later, there was a swing of emphasis to sports and an emphasis on character and personality development and the teaching of skills for leisure time use. To secure an appropriate balance between the various objectives of physical education and to consider the individual needs of boys and girls are the major problems for the future of this field.

3. Many medical men composed the roster of pioneer leaders in physical education in America. Such names as Dr. James H. McCurdy, of Springfield College; Dr. Dudley A. Sargent, of Harvard University; Dr. R. Tait McKenzie of the University of Pennsylvania; Dr. William G. Anderson, of Yale University; Dr. Edward Hitchcock, of Amherst College, and Dr. Joseph E. Raycroft, of Princeton University, are mentioned to list but a few. In more recent years, with the dominant application of physical education in the schools, leaders have come primarily from the ranks of doctors of philosophy and, more recently still, of doctors of education.

4. The therapeutic value of physical activity has long been recognized by teachers of physical education. Based originally upon Swedish "medical gymnastics," corrective exercises have been utilized by physical educators, and courses in this area have been requirements in training programs. Not until World War II, however, was the full range of activities included in physical education recognized as having therapeutic value and utilized in the convalescence of battle casualties.

5. Prior to World War I, physical education did not appear generally in public school curriculums. Only two states, North Dakota and Idaho, had state laws requiring physical education in the schools. By 1932, thirty-six states, which represented 90 per cent of the population, had state laws.[2] At present, all but eight states have such statutes.

6. The number of physical educators in the United States has increased tremendously. In 1918, there were approximately 10,000 men and women with training in this field; in 1932, 20,000; and in 1947, 65,000. It has been estimated that there will be 125,000 physical educators in the United States by 1960.[3]

It is obvious, therefore, that the training of physical educationists today is aimed primarily at preparing teachers and supervisors of school programs. The therapeutic aspect, as reflected in the use of corrective exercise, is present, and elementary courses in this area have traditionally been requirements in undergraduate physical education training programs. Study of the basic sciences, however, is stressed and will be considered later in this paper.

Background of Professional Education

As the major purpose of this paper pertains to professional training in physical education, it would be well next to give a brief background of its development in American colleges and universities. The following information provides an overview of this growth.

The earliest attempt to prepare teachers of physical education was made during the Civil War by Dio Lewis at his Normal Institute for Physical

1. Leonard, F. E., and Affleck, G. B.: A Guide to the History of Physical Education, ed. 3, Philadelphia, Lea & Febiger, 1947.
2. Rogers, J. F.: State-Wide Trends in School Hygiene and Physical Education, Washington, D. C., Department of the Interior, Office of Education, 1934.
3. Miller, B. W.: Unpublished data.

Education in Boston. The first courses at the institute were nine to ten weeks long. Other schools of a similar nature were opened subsequently. Colleges and universities accepted this new type of training first as summer courses, with Harvard University leading the way in 1887. Wellesley College for women and Springfield College for men early included professional training in physical education in their curriculums.[1] The first state normal school to provide such training was the one at Ypsilanti, Mich., in 1894, and the first state university was the University of Washington in 1896.[4]

Before 1910, the training of instructors was left largely to private normal schools. Owing to passage of state laws making physical education compulsory in elementary and secondary schools following World War I, the demand for men and women qualified to teach in this field increased tremendously. As a result, college after college inaugurated training programs to meet the demand. The numbers were as follows: in 1918, 20 institutions; in 1929, 139 institutions; in 1944, 295 institutions and, in 1947, 361 institutions.

Early training programs for instructors in physical education were completed in a few weeks only. Later, one, two and three year courses appeared, until finally the only acceptable programs required four years of college training and a degree. Five year programs are now being initiated. The minor in physical education still exists but is recognized as inadequate for teachers by qualified professional leaders.

The first graduate major in physical education leading to the master's degree was established in 1901 by Columbia University. Springfield College and Oberlin College were the only other institutions providing opportunities for graduate study prior to 1918. The first doctor of philosophy degree with concentration in this field was offered in 1924 by two institutions: Teachers College, Columbia University, and the School of Education, New York University. By 1933, thirty-two institutions in the United States provided graduate study in physical education.[5] By 1942, this number had increased to fifty-six, and twenty of these institutions offered the doctorate.[6]

The most profound effect on physical education in this country has been the requirements adopted by state departments of education for the certification of teachers. Although there is little similarity of requirements in different states (as they range from no requirements in Massachusetts to requirements of thirty-six semester hours of physical education, eighteen semester hours of basic sciences and eighteen semester hours of professional education in New York), the general influence has been to improve training for the profession of teaching physical education. For example, it is now generally necessary to fulfil the requirements for a bachelor's degree[7] in order to teach. In 1931, only nineteen states required a degree; prior to World War II, the number had reached forty-three states, only five accepting less than a degree for certification.[8]

During World War II, the demand for trained physical educators by the armed forces was so great as to cause a critical shortage of men teachers in this field. The issuance of emergency certificates to untrained personnel became usual practice in all states in order to continue physical education in

4. Brownell, C. L.: The Present Status of Professional Preparation of Teachers in Physical Education, Research Quart. 3:107 (May) 1932.

5. Clarke, H. H.: A Survey of the Requirements for the Master's Degree in Physical Education; Nash, J. B.: Interpretations of Physical Education; Professional Preparation, New York, A. S. Barnes & Company, 1935, vol. 5, chap. 39.

6. Hewitt, J. E.: Status of the Graduate Faculty in Physical Education, Research Quart. 16:231 (Oct.) 1945.

7. Morehouse, L. E., and Schaaf, Oscar: Prerequisites for Teacher Certification in Physical Education in the United States, Research Quart. 13:286 (Oct.) 1942.

8. Blesh, T. E.: An Analysis of the Prewar Certification Requirements for Teachers of Health and Physical Education in the Forty-Eight States, Research Quart. 18:54 (Mar.) 1947.

the schools.[9] Thus, unless the states now refuse to renew such certificates, these unqualified persons will continue to teach.

At present, there is no professional physical education course which is recognized as standard. Several attempts, however, have been made to evaluate professional curriculums and to establish proper machinery for accrediting institutions preparing teachers in this field. In 1913, Dr. Charles H. Judd, of the University of Chicago, advocated the appointment of a permanent committee on standards for the training of physical educators.[1] Immediately after World War I, the American Physical Education Association appointed a committee to study the problems of teacher training. This committee reported in 1920, but action did not result because of the tremendous demand for teachers of physical education at that time and thereafter. Again, in 1929, another committee from the same association reported on the curriculums of 139 institutions preparing teachers of physical education in the United States. Proposals to inspect institutions where teachers were being trained and to prepare an accredited list failed because of insufficient funds to finance institutional inspections.[10]

A very extensive effort to prepare standards and to establish accreditation in physical education was made in the 1930's by a National Study Committee, composed of representatives from the following six national associations: American Association for Health, Physical Education and Recreation; Society of State Directors of Physical and Health Education; City Administrative Directors Society; National Association of Directors of Physical Education for College Women; College Physical Education Association, and Department of School Health and Physical Education of the National Education Association. Some experimental inspections of training programs in physical education were made, but the accrediting process did not become effective.[11] Now the American Association for Health, Physical Education and Recreation again is concerned with standards of training. Since the war, a large number of institutions have added training programs in physical education to their curriculums. The need for regulating this movement by insisting on minimal standards of training is very evident, and a standing committee of the Association once more has been appointed to attack the problem energetically. The success of this latest effort is essential if the program is to gain the status and prestige of which it is capable.

The Physical Education Curriculum

The real problem in the training of physical educators centers primarily around the question, What should be included in the preparation of the prospective teacher of physical education? The most recent and searching study pertaining to this question was made by Blesh.[12] He utilized the following three factors for evaluation of curriculum content in this field: (1) analysis of the requirements for certification of teachers in each of the forty-eight states, (2) study of the physical education courses of study appearing in the 1935 to 1940 catalogues of seventy-five selected schools offering major programs in this field and (3) the opinions of thirty-one carefully selected experts in physical education. The following training program is proposed from the recommendations made by Blesh and may be considered desirable in accordance with present thought and best practice (reference to the usual institutional liberal arts or general education requirements for the bachelor's degree is omitted):

9. Cobb, Louise S., and Landreth, V. S.: War Emergency Teacher Certification in Physical Education in the United States, Research Quart. 14:342 (Dec.) 1943.
10. Affleck, G. B.: Progress and Plans of the National Committee on Teacher Training in Physical and Health Education, Proc. Coll. Physical Education A., p. 146 (Dec. 27-28) 1934.
11. National Committee Report on Standards: National Study of Professional Education in Health and Physical Education. Research Quart. 6:48 (Dec.) 1935.
12. Blesh, T. E.: Evaluative Criteria in Physical Education, Research Quart. 17:114 (May) 1946.

1. Foundation sciences, including: biology, human anatomy and human physiology.
2. General psychology.
3. Professional education, including: history of education, principles of education. educational psychology, methods of teaching and student teaching.
4. Technical training, including: kinesiology, physiology of exercise, measurement and evaluation, physical examinations, corrective exercise, normal growth and development, nature and function of play, training and first aid, school programs in physical education, recreation leadership, camping, administration of physical education and physical skills and coaching technic. Under physical skills should appear: aquatics, elementary games, team sports, individual and dual sports, gymnastics, tumbling and dancing.

The well-trained physical educator must have a thorough grounding in foundation sciences, must understand the learning process and the effective applications of his modalities to the education and development of the individual, must have great versatility in teaching the many activities included in a physical education program and must be able to administer and supervise a varied program of physical education and athletics. That it is difficult to achieve the objective of training physical educators adequately within the limits of a four year college program and still provide the liberal-cultural education of the student is not to be denied. Many colleges and universities, as a consequence, are not providing as complete a course of study as is outlined. The evidence provided by three recent studies follows:

1. Russell study: Russell[13] studied the trends in physical education teacher training in the thirty-six teachers colleges of the North Central Association area through an analysis of their catalogues from 1910 to 1940.

2. Study of Mayo Clinic transcripts: As physical education is one of the fields from which candidates are approved for training as physical therapy technicians, at the Mayo Clinic one of us analyzed 144 transcripts of credits of graduates from schools of physical education. Of this number, 136 were women and 8 were men. Fourteen applicants did not have a college degree, and 4 had master's degrees. Approximately one-half of these students received bachelor's degrees after 1940; the remainder had obtained the degree back over the years to 1923. Colleges located in twenty-three states and Canada were included in the group. The largest number of students came from Wisconsin (17), Pennsylvania (16), Michigan (15), Minnesota (13) and Illinois (10).

3. Questionnaire study: In order to obtain an up-to-date, postwar picture of professional training in physical education, one of us sent questionnaires to 361 institutions known to be offering undergraduate work in this field. Information pertaining only to courses actually required of all students during the academic year of 1946-1947 was requested. At the time this paper was written, 133 replies had been received reporting requirements for men; and 127 for women. These institutions were located in thirty-eight states and provided a rather wide distribution of practice throughout the United States. Because a comparison of the course requirements for men and women majors in physical education revealed only minor differences, and these were particularly in physical skills, this report refers only to the requirements for men.

A summary of the significant findings pertinent to this paper contained in the three studies is as follows:

1. Physical sciences: Courses in the physical sciences are not generally required (although they frequently may be elected). Forty per cent of the 133 institutions included in the questionnaire study insisted on a course in chemistry, six to eight semester hours being the usual requirement. Only

13. Russell, Helen L.: Teacher Education in Physical Education with Special Reference to the Major Programs for Women in Selected State Teachers' Colleges, Research Quart. 16:3 (Mar.) 1945.

thirteen institutions required that students take a course in physics; two permitted them to take either chemistry or physics, depending on the choice of the student.

However, in the transcript study, 82 per cent of the 144 applicants had at least one course in the physical sciences as an undergraduate. Sixty-three per cent had courses in chemistry, the prevalent number of semester hours being six to eight; 29 per cent had courses in physics, the modal number of semester hours being six. A scattering of other physical science courses had been taken by this group.

2. Biologic sciences: Only one applicant in the transcript study and one institution in the questionnaire study failed to include some courses, in the biologic sciences in undergraduate programs. The distribution of these courses for the transcript and questionnaire studies is shown in table 1. Pertinent

TABLE 1. — *Biologic Science Courses Required of Physical Education Majors as Revealed by Mayo Clinic Transcripts and Postwar Questionnaires.*

Biologic Science Courses Required	Institutions %: Mayo Clinic Transcripts	Postwar Questionnaires
Anatomy	92	86
Biology or zoology	92	77
Physiology	82	77
Kinesiology	63	77
Physiology of exercise	34	38

comments pertaining to requirements in biologic sciences as shown by the three studies reviewed are as follows:

(*a*) Courses in biology or zoology, anatomy and physiology appear on more than three-fourths of the transcripts and are required by more than three-fourths of the institutions. Kinesiology is also required by more than three-fourths of the institutions and appears on a majority of the transcripts.

(*b*) The range of semester hours in this area shown on the transcripts was from five to forty, with the median located at eighteen semester hours. Of the group of 143 students whose transcripts showed a record of biologic sciences, 75 per cent completed at least fifteen semester hours and 25 per cent completed twenty-four or more semester hours. All but 10 of the 144 students completed undergraduate study in biology or zoology and in anatomy.

(*c*) The catalogue study by Russell revealed similar emphasis upon the biologic sciences, although the basic science requirements of the thirty-six teachers colleges decreased from 22 semester hours in 1910 to 15.5 semester hours in 1940.

(*d*) In all three studies, physiology of exercise received relatively light emphasis. This is surprising when the importance attached to this subject by leaders in physical education is considered. (It was recommended in all national committee reports.) This course was never required by more than five of the thirty-six institutions included in Russell's catalogue study; it appeared on 34 per cent of the transcripts and was listed as a required course on 38 per cent of the questionnaires.

(*e*) A course in bacteriology was included as a biologic science requirement by 15 per cent of the institutions answering the questionnaire.

3. Psychology: At least one course in psychology appeared on 96 per cent of the transcripts and was listed on 94 per cent of the questionnaires. The courses appearing most frequently were general psychology (83 per cent of the transcripts and 64 per cent of the questionnaires) and educational psychology (57 per cent of the transcripts and 80 per cent of the questionnaires). Seventeen other psychology courses were listed on the transcripts of from 1 to 11 applicants.

4. Corrective physical education: Forty per cent of the transcripts and 64 per cent of the questionnaires listed a course in corrective physical education. This appears to be a relatively smaller number than would be expected when the importance of this subject as traditionally practiced in physical education is realized.

5. Hygiene: A course in personal hygiene is a common requirement among the 133 institutions included in the questionnaire study; 77 per cent make it mandatory. Approximately one-half of the colleges and universities required community hygiene, and a few (14 per cent) insisted on a course in mental hygiene.

6. Professional education: The questionnaire study also revealed that all but three of the institutions required of their majors in physical education specific study in professional education. The median and modal requirement was eighteen semester hours. Twenty-five per cent of the institutions required twenty semester hours, while a similar percentage permitted fourteen semester hours or less. The typical courses required were history of education, principles of education, educational psychology, methods of teaching and student practice teaching.

7. Technical physical education: The median number of semester hours of courses in technical physical education required by the institutions answering the questionnaire was thirty-four; the modal number, thirty-six. The first quartile was twenty-eight, and the third quartile, thirty-nine. The courses

TABLE 2. — *Technical Physical Education Courses Required by at Least 25 Per Cent of the 133 Institutions.*

Courses Required	Institutions, %
Organization and administration	100
Physical education and athletic skills	100
First aid	78
Corrective physical education	64
Philosophy and principles of physical education	56
History of physical education	55
Tests and measurements in physical education	51
Physical inspection	37
Camp leadership	27

most generally required by these institutions appear in table 2.

The only two types of courses required by all the institutions were organization and administration, and physical education and athletic skills. Under this latter classification are grouped such activities as aquatics, all forms of team, dual and single sports, elementary games, gymnastics, tumbling and dancing. More than 50 per cent of the institutions also included such courses as: first aid, corrective physical education, philosophy and principles of physical education, history of physical education and tests and measurements in physical education.

In brief comment on this survey, it may be pointed out that the type of training a physical educator receives depends largely on the institution he attends. At some institutions, the requirements are very demanding; at others they appear quite meager. At this point, however, it should be emphasized that the studies reviewed refer primarily to actual requirements and are not involved with elective courses, except as they may have been taken by applicants for physical therapy training at the Mayo Clinic.

Relationship of Training in Physical Education to Reconditioning and Rehabilitation of Patients

In evaluating the training of physical educationists for reconditioning and rehabilitation of patients, it should first be pointed out that the training of physical educationists in the past, as well as at present, was not designed to prepare technicians for work in this field. As was indicated earlier in this paper, the vast majority of institutions in this country providing training programs in physical education are doing so primarily to provide instructors

in schools. Consequently, the dominant role in shaping these training programs has been to supply the needs of education.

As a consequence of this emphasis, it seems entirely feasible not to evaluate the training of physical educationists for direct application to reconditioning and rehabilitation but to assay its contribution in the light of essential background for specialized training of technicians in this field. This is the position taken in relation to training other technicians in physical medicine, such as physical therapists and occupational therapists. The graduate in physical education desiring to enter the field of physical reconditioning should be accorded similar consideration, as he is definitely not prepared upon graduation to work with patients or to treat disabilities.

The answer to the problem of providing properly trained physical educationists for reconditioning and rehabilitation is postgraduate study at institutions providing specialized programs in this new field. The adequately trained physical educator needs to take more courses in anatomy, kinesiology, physiology and physiology of exercise than he had as an undergraduate and must know their relationship to pathologic conditions. He needs to understand the pathology of the various disabilities he will encounter and the necessity for physical activity in surgical, orthopedic, neurologic and psychiatric cases. He must be thoroughly acquainted with the modalities of exercise, adapted sports, aquatics and recreational activities and should have extensive supervised clinical experience with patients in hospitals and rehabilitation centers. This type of study is not provided in present four year and graduate programs in physical education. Thus, the need for specialized training in reconditioning is evident and will be accepted by well-informed and competent physical educators.

In addition, some doubt can be cast upon the qualifications of many graduates of schools of physical education as competent to enter into specialized study in reconditioning. The studies of training programs reported in this paper point to serious inadequacies at many institutions. In part, at least, the scientific background of the applicants for the course for physical therapy technicians at the Mayo Clinic was superior because of the requirements for admission established there and by the Council on Medical Education and Hospitals of the American Medical Association.[14] Even at the Mayo Clinic, however, the transcript analysis revealed that some applicants had not had kinesiology as undergraduates and a large number had not had physiology of exercise. In the data obtained from questionnaires by one of us (table 1), the situation was much worse; 23 per cent of the institutions did not require biology; 23 per cent, physiology; 29 per cent kinesiology; and 62 per cent, physiology of exercise.

It is suggested, therefore, that physical educationists applying for training as technicians in reconditioning and rehabilitation be required to present a bachelor's degree and to have taken the following courses:

- Basic sciences: minimum of twenty-six semesters hours
  - Minimum
    - Biology (or equivalent)
    - Anatomy and kinesiology
    - Physiology and physiology of exercise
  - Desirable
    - Chemistry
- Psychology
- Hygiene
  - Personal hygiene
  - Mental hygiene (or equivalent)
- Technical training in physical education
  - Undergraduate major in physical education

14. Approved Schools for Physical Therapy Technicians, J. A. M. A. 133:1149 (Apr. 12) 1947.

(Minimum: thirty-six semester hours)
Methods courses and practice teaching experience

Unlike technicians in physical therapy, technicians for reconditioning work should come entirely from the field of physical education. Familiarity with the numerous physical and athletic activities and the method of their presentation is essential for technicians in this field.

As is well known, physical educationists were utilized extensively by the armed services in the physical reconditioning of battle casualties and many are similarly engaged in postwar Army and Veterans Administration hospitals. The technical and professional training of these men is not generally known. In the Army Air Force, however, nearly all the officers who were doing work in reconditioning had degrees in physical education and many had master's degrees. Approxmately one-half of the enlisted men had degrees in physical education and about 25 per cent more had had some training in physical education. It is believed that this branch of the service had a more favorable situation in this respect than either the Army or the Navy.

The professional background of the physical educationists who are now helping with corrective physical rehabilitation in the Veterans Administration hospital program has not been reported. In evaluating the qualifications of these men, however, it should be remembered that they have had special courses in reconditioning and have had extended service in service and veterans' hospitals under medical supervision. They were selected carefully from a much larger number engaged in Army, Navy and Air Force physical reconditioning programs during the war. As a result, they are much better prepared for the mission they perform than is a person who was graduated from college in 1947 with a major in physical education and who had had no previous experience in this field. It seems logical to presume, therefore, that the qualifications of these men must be evaluated in terms of the job they have done on the operational level after extensive experience and in-service training under competent medical supervision rather than entirely in terms of college degrees and formal courses passed. This observation will also apply to those who have had advanced training in correctives at schools of physical education.

A final point of interest that might well be mentioned is that physical reconditioning has attracted men. In the older field of physical therapy, most of the technicians have been women. For example, 94 per cent of the applicants for the course at the Mayo Clinic were women. The choice of the newer field by men should prove a definite asset to physical medicine and rehabilitation.

Discussion

Dr. George D. Wilson (Asheville, N. C.): Professor Harrison Clarke and Dr. Elkins have prepared a paper which brings out the fact that there is no recognized standard of physical courses for applicants in physical therapy, which surely will be rectified in the near future.

Among the preparatory subjects I was glad to see a course in personal hygiene. This is very essential in any personnel handling patients.

It is also suggested that physical education in the future should have instruction in patient management. I should like to see, in lieu of so much coaching technic, that physical educators going into physical therapy have a course in patient management.

I should like to ask Dr. Clarke one question: Will there be or should there be adjustments in qualification credit for reconditioning or corrective rehabilitation men to be admitted to physical therapy schools, to stay in corrective physical rehabilitation?

Dr. Clarke (closing): I am not the one to answer that question ultimately. I can merely give an opinion.

I believe you are referring to men who have shown outstanding competence in the veterans programs and other programs now being conducted, who do not have a basic training in physical education.

I personally believe this would have to be placed on an equivalent basis, and when a man's experience would compensate for lack of formal training it should be taken into account.

MEDICAL NEWS

Dr. Zeiter Appointed

Dr. Walter J. Zeiter, Executive Director of the American Congress of Physical Medicine has been appointed Assistant to the Executive Director of the Cleveland Clinic Foundation.

Western Section, American Congress of Physical Medicine

The Western Section of the American Congress of Physical Medicine presented the following program, Jan. 22, in the Los Angeles County General Hospital:

Dr. Harold Dinken, Denver, Colo., Rehabilitation in the Rocky Mountain Area.
Dr. James G. Golseth, Los Angeles, Electromyography as Related to Physical Medicine.
Dr. Frances Baker, San Francisco, Physical Medicine in Rheumatoid Arthritis.
Dr. A. Estin Comarr, Van Nuys, Calif., Management of Paraplegic Patients.
Dr. James B. Mennell, London, Eng., To Move or Not to Move.
Dr. Everill W. Fowlks, Portland, Oregon, Physical Medicine in a General Veterans Hospital.
Dr. Clarence W. Dail, Los Angeles, A Study of Microwave Heating.

An evening session with dinner followed and the speakers and their subjects were: Dr. Andrew H. Dowdy, "Atomic Energy"; Dr. James B. Mennell, London, Eng., "Some Contrasts."

The program was in charge of the officers of the section, Dr. Arthur C. Jones, Chairman, and Dr. Fred B. Moor, Secretary.

New York Society of Physical Medicine

The following scientific program was presented at the regular monthly meeting for January of the New York Society of Physical Medicine: "Progress of physical medicine in 1947," M. Lowenthal, M.D.; "Lantern slide representation of manipulative maneuver, by Dr. James B. Mennell," I. Blum, M.D.

Seminar in Physical Medicine

Physical Medicine was the subject of a one day seminar Wednesday, February 4, in Bay City at the Wenonah Hotel, with the following lectures:

Dr. Franklin Top, Detroit, Physical Medicine in the Treatment of Poliomyelitis.

H. Barbara Jewett, Detroit, An Occupational Therapy Technician in General Practice.

Dr. Frederick B. House, Ann Arbor, Management of Cerebral Palsy.

Dr. Max K. Newman, Detroit, Physical Medicine in Vascular Disease of the Extremities.

Dr. Walter M. Solomon, Cleveland, Physical Medicine in Arthritis.

The new department of physical medicine at Bay City's General Hospital was inspected by registrants at 5 p. m. prior to dinner at the hotel. In the evening Dr. Louis B. Newman, Veterans Administration Hospital, Hines, Ill., spoke on "The Management of Paraplegics — Spinal Cord Injuries." Sponsors of the seminar were the Bay County Medical Society, the Michigan State Medical Society's Committee on Postgraduate Medical Education, Wayne University and the Bay City General Hospital.

Pennsylvania Academy Meets

A meeting of the Pennsylvania Academy of Physical Medicine was held Thursday, January 15, 1948, at the Jefferson Medical College. The following papers were presented and discussed: "Relief of Pain and Muscle Spasm with the Sinusoidal Current" by Dr. Richard Smith; "Scalenus Anticus Syndrome" by Dr. Anthony F. DePalma, and "Demonstration of Shoulder Cases" by Dr. William H. Schmidt.

Section on Physical Medicine of the Southern Medical Association

The Section on Physical Medicine of the Southern Medical Association had a record attendance at the 41st annual meeting of the Southern Medical Association which was held in Osler Hall, Medical and Chirurgical Faculty Building, Baltimore, Md. The program speakers accentuated department operation, patient and community benefits derived from physical medicine departments and rehabilitation centers.

The following officers were elected:

Chairman — Dr. Wayne McFarland, Washington, D. C.

Vice-Chairman — Dr. George D. Wilson, Asheville, N. C.

Secretary — Dr. W. Jerome Lee, Richmond, Va.

Dr. George Wilson Awarded the Legion of Merit

The Legion of Merit has been awarded to Lieutenant-Colonel George D. Wilson. The citation reads as follows: For "Outstanding services as Chief, Reconditioning Service, Oliver General Hospital, Augusta, Georgia, from July 25, 1944, to December 18, 1945. He devised and put into use several pieces of apparatus, which were used in remedial exercises, thus materially shortening the number of hospital days, and greatly improved the condition of the patients on discharge from this hospital. He also inaugurated a method for the determination of the extent of nerve injuries which has been adopted by the medical profession. Lieutenant-Colonel Wilson's devotion to duty, initiative and outstanding qualities of leadership contributed materially to the successful accomplishment of the mission of the Medical Department."

(Continud on page 112)

ARCHIVES of PHYSICAL MEDICINE
OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIALS .·.

ECONOMICS AND THE PRACTICE OF PHYSICAL MEDICINE

The economics of the practice of physical medicine needs consideration. It is timely and warranted that the physiatrist recognize the status of physical medicine today and give practical and revised thinking to his specialty as it pertains to the economic factors. In the past the Physical Therapy Department and its personnel were not much of an economic problem for a hospital or institution. The superintendents were usually content to tolerate such a department as long as the demands were not too great and the income equalled the expenses. It was too often neglected or abused. This is an old story. The situation is different today. A hospital without a properly staffed and equipped physical medicine department is not considered a first class institution. With this change, new problems concerning its management have arisen.

Doctor E. E. Irons of Chicago defines economics as a "classless scientific study of the means by which people earn their living and how they spend their income." In a broad sense it is appropriate that the above definition be applied to the practice of Physical Medicine. The purpose of this editorial is to call attention to the members of the American Congress of Physical Medicine and the readers of the ARCHIVES OF PHYSICAL MEDICINE certain policies and practices with the hope of securing an expression in writing of their reactions. This will help and guide the Committee on Medical Economics of the Congress.

Foremost in the economic set up is the personnel for the department. It is obvious that the best equipped and staffed department is wasted without a properly trained physiatrist in charge. Therefore, what practical plan can be arranged which will be fair to the patient, the hospital and the physician? Many methods are in vogue for compensating the director, some of which are equitable to the physician and to the hospital and others which are the reverse. These plans usually follow one of four types —

1 — the physiatrist is on a salary basis either full time or part time.

2 — the physiatrist maintains the department as an independent office in the hospital.

3 — the physiatrist receives a salary plus a percentage of the gross or net receipts.

4 — the physiatrist gives his time without remuneration.

The first plan meets with the legal objection that it places the hospital, a corporation, in the position of practicing medicine, which is clearly illegal. This applies not only to physical medicine but to roentgenology, anesthesiology and pathology. This practice by a hospital corporation is undoubtedly illegal by statutes and pertinent court decisions. The second plan is found less frequently but has considerable merit. It is interesting that in a survey by the American College of Radiology[1] 14 per cent of the radiologists in answering the questionnaires considered themselves independent practitioners in the hospital; that is, they pay the hospital a fixed rental, a rental based on

1. Cahal, Mac F., and Nyberg, C. E.: The Economics of the Practice of Radiology, J. A. M. A. 135:1078 (Dec. 20) 1947.

receipts or a fee per private case. The following quotation expresses their opinion: "It is encouraging to note the increase in the number of radiologists operating the X-ray department of a hospital as independent practitioners. Such an arrangement meets the requirements of the Principles of Medical Ethics." The third plan is frowned on by some physicians and hospitals. It has an air of commercialism which may or may not be justified. It can be equitable to both parties. Again to quote the survey of the radiologists it was found that over one-half of the radiologists who have such an arrangement with the hospital receive from 40 to 55 per cent of the gross or net receipts in addition to a salary. The other radiologists range all the way from 10 per cent to 75 per cent of the gross or net receipts. The authors of the survey conclude that "the total cost of operating an X-ray department, excluding professional services amounts to 45 to 55 per cent of the gross income." It would seem that the expenses for a department of physical medicine would be comparable.

An item which has been most vexatious in certain sections and which is included in medical economics is the subject of hospital service plans and the inclusion of physical treatments as part of that service. The controversies have not been limited to Physical Medicine but apply to Radiology, Pathology and Anesthesiology as well. Essentially Physical Medicine, Radiology, Pathology and Anesthesiology are medical services and on principle, the inclusion of them in a hospital plan is not legally permissible. The hospital plans desire to cover these special services in their contracts and argue that these services are provided by equipment owned by the hospitals and the charges being generally included on the hospital bill are really hospital services and as such should be included in the plan. It is not difficult to see why as comprehensive a coverage as possible would be most attractive to the subscribers. In a survey of 87 Blue Cross plans in the larger cities throughout the country, 44 include physical therapy as part of the service, whereas 43 do not.

It is a little less than ridiculous for the survey conducted by the Federal Security Agency[2] to cite as reasons for opposition of including these auxillary services in the contract as follows:

"1. These physicians feel that inclusion would injure their prestige with the rest of their profession and the general public.

"2. Many of these physicians were anxious to maintain or strengthen their economic and professional independence of hospitals: they wished to avoid being salaried employees of hospitals.

"3. They believed that inclusion of their services under the hospital plan might result in loss of income, a belief strengthened by the fact that in some cases proposals for inclusion of their services were made without giving them adequate voice in the determination of the basis and amount of remuneration for their services."

The arguments against the inclusion are so conclusive that it is surprising that any discussion is necessary. However the facts show that 50 per cent of the plans do include physical treatments. Certainly the members of the American Congress of Physical Medicine rightfully can voice their opinions of this procedure.

These two problems are cited, perhaps not the most important but because they have created very definite opinions and as such will initiate an expression. There are many other economic factors which are directly involved in a hospital Physical Medicine Department: the salary of the therapist, the standardization of fees for treatment, the fee permitted by the Veterans Administration and the Industrial Commissions of the various states,

2. Reed, Louis S.: Blue Cross, and Medical Plans: Federal Security Agency, U. S. Public Health Service, Washington, D. C., Oct., 1947.

the management of departments as to space, equipment and other matters, etc. All these items are more or less related to the larger general hospitals where a department is functioning. An equally important field for consideration is the economic situation in the smaller hospitals or the hospitals in the smaller communities. In most instances no department of physical medicine is present chiefly because of economic aspects. Discussion of this must wait for another time.

It is hoped that these remarks about any phases of the problems will arouse sufficient interest to prompt the readers to send in their opinions to:

Chairman, Medical Economics Committee,
American Congress of Physical Medicine,
30 North Michigan Avenue,
Chicago 2, Illinois.

Or contact the members of the Medical Economics Committee, who are:

Walter M. Solomon, Chairman,
Cleveland, Ohio.

Dean M. Hayes,
Washington, D. C.

Donald J. Erickson,
Rochester, Minn.

Arthur C. Jones,
Portland, Ore.

Roy W. Fouts,
Omaha, Nebr.

Charles O. Molander,
Chicago, Ill.

Bror S. Troedsson,
Orange, N. J.

26th Annual Session

SCIENTIFIC EXHIBIT SPACE

Requests for scientific exhibit space for the 26th Annual Session to be held at the Hotel Statler, Washington, D.C., Sept. 7 to 11, 1948 should be made at once. All requests must be received no later than June 1, 1948. Please give a brief description of your exhibit and what your space requirements are. Address all inquiries to the American Congress of Physical Medicine, 30 North Michigan Avenue, Chicago 2, Illinois.

Medical News

(*Continued from page 108*)

Magnuson Named Medical Director of VA

Dr. Paul Magnuson, nationally-known orthopedic surgeon and closely identified with the reorganization of medical care in Veterans Administration hospitals, was named chief medical director for VA by Carl R. Gray, Jr., administrator.

In announcing the appointment, General Gray pointed out that this will assure an uninterrupted continuation of the medical program of the Veterans Administration which was inaugurated under Dr. Hawley.

Dr. Magnuson, former professor of surgery and chairman of the Department of Bone and Joint Surgery at Northwestern University Medical School, Chicago, succeeds Dr. Paul R. Hawley, resigned Jan. 1 as medical chief and who now is serving Mr. Gray as special assistant and advisor on medical problems.

Appointment of Dr. Magnuson is effective immediately.

Dr. Magnuson, a native of St. Paul, Minn., has been intimately associated with VA's Department of Medicine and Surgery since its inception, Jan. 3, 1945. During that time he has been closely associated with Dr. Hawley in reorganizing VA's medical program. Working with Dr. Hawley, Dr. Magnuson played a large role in affiliating more than half of VA's 126 hospitals with Class "A" medical schools over the county and in the establishment of VA's residency training program.

Dr. Magnuson's first position with VA was as chief of the Research and Education unit. In this position he launched and completed the residency training program and also aided in starting a comprehensive research program into many of the little-known ailments and diseases suffered by veterans.

On Sept. 19, 1947 he was appointed acting chief of Professional Services, a position he has served in since.

As chief medical director, Dr. Magnuson will continue to work closely with Dr. Hawley. Dr. Hawley, as special assistant and advisor to Mr. Gray, will continue to assist in carrying out the medical program and the continued association of these two nationally-famous doctors, will insure that there will be no change or delay in the VA medical program.

Dr. Magnuson took his pre-medical training at the University of Minnesota and was graduated from the University of Pennsylvania Medical School in 1908.

He is an attending surgeon at Passavant Memorial Hospital, Chicago, and senior consulting orthopedic surgeon at Wesley Memorial Hospital, Chicago. He also is civilian consultant to the Surgeon General of the Department of the Army.

He is the author of "Fractures," originally published in 1933, the fourth edition of which appeared in 1942. At the direction of the National Research Council, he also wrote "Section on Ununited Fractures."

He is a founder-member of the American Board of Surgery; a fellow of the American College of Surgeons and of the Southern Surgical Association.

Dr. Magnuson is a member of the following organizations: American Board of Orthopaedic Surgery; American Orthopaedic Association; American Academy of Orthopedic Surgeons; Clinical Orthopedic Society; Chicago Orthopedic Society; Western Surgical Association; American Association of Industrial Surgeons; American Association for the Surgery of Trauma; American Medical Association; Illinois State Medical Society; Chicago Surgical Society; Chicago Medical Society; the Institute of Medicine of Chicago, and a member of the Committee on Orthopedic Surgery of the National Research Council.

Annual Conference of the American Physiotherapy Association

The 25th annual conference of the American Physiotherapy Association will be held at the La Salle Hotel in Chicago, May 23-28, 1948.

The scientific program will consist of lecture-demonstrations and panel discussions on the following subjects: The care of the Paraplegic patient; the care of poliomyelitis patients from the functional standpoint; physiology applied to muscle reeducation and the contribution of physical therapists to nursing education. These subjects will be considered from the viewpoint of contributing specifically to technics and procedures of physical therapy.

In addition, part of the program will be devoted to scientific papers on special subjects: peripheral circulation, treatment of hand injuries, physical therapy for the psychiatric patient and the presentation of papers on research which is being done or has been completed by a physical therapist.

Physical Therapists Needed

The Veterans Administration Medical Teaching Group (Kennedy Veterans Hospital), Memphis, Tennessee is accepting applications for Physical Therapists who are graduates of an A. M. A. approved school.

Kennedy Veterans Hospital is the Medical Training Center for the Veterans Administration. The bed capacity is approximately 1500, consisting of General Medical, General Surgical, Neuropsychiatric and Tuberculosis. At the present, attractive housing accommodations are available at the hospital.

If you are interested, fill out Civil Service Application Form No. 57, which can be secured at

any postoffice and mail to Dr. Florence I. Mahoney, Chief, Physical Medicine Rehabilitation Service, VA, Medical Teaching Group, Kennedy Hospital, Memphis 15, Tennessee.

Dr. Donald Anderson Named Consultant

Dr. Donald G. Anderson, Secretary of the Council on Medical Education and Hospitals of the American Medical Association has been named one of the members of the Consultants Board of the Bureau of Medicine and Surgery of the Navy.

People

The resignation of Mrs. Meta Cobb as Executive Secretary of the American Occupational Therapy Association on November 15, leaves a great gap in this organization's staff. Her ten years of help, leadership and service to that organization will be missed by the membership.

Bernard Baruch

Serially appearing in the *New Yorker* are articles giving sketches of the life of Bernard Baruch. Quoting from the article of Jan. 3, Baruch said, "I don't really care about money. When I made my first million dollars—I was about thirty then—I went to my father, and I was pretty excited, as you can imagine, and I asked him if he wanted to go down to the bank vaults and see the million, the actual securities and bankbooks. My father was an extraordinary man, Mr. Crampton. My father had the finest collection of natural faculties of any man I ever knew, and he constantly improved what he had. He was able, by reading and by study, to assimilate anything, and he had a mental machine that was able to take in whatever was good and reject what was bad. He was a handsome man, too—six feet tall, slender but straight, with a dark beard and mild blue eyes that looked straight at you. A very imposing personage. He was a doctor and he worked all his life for his fellow-men. His passion was physical therapy. He conducted some of the first experiments in hydrotherapy, and that's why I'm so interested in this spa. People think I'm up here to see the races. Actually, I'm preparing a report for Governor Dewey on the baths. — *New Yorker,* Jan. 3, '48.

First International Poliomyelitis Conference

The National Foundation for Infantile Paralysis is sponsoring the First International Poliomyelitis Conference at the Waldorf-Astoria Hotel next July 12 to 17.

The Department of State has been requested to transmit invitations to more than 60 foreign governments to send official delegates to the conference. These officials will be asked to present summarizations of the problems of poliomyelitis in their countries at a special session. Presiding officer at this session will be Thomas Parran, M.D., Surgeon General of the United States Public Health Service.

Official host to the delegates will be Basil O'Connor, President of the National Foundation, while Hart E. Van Riper, M.D., the Foundation's medical director, has been appointed general chairman of the conference.

The program will include scientific and technical papers on research and treatment of poliomyelitis to be presented by professional authorities in the field from this country and abroad. In addition, there will be panel discussions on the various subjects.

It was announced also that conference headquarters have been established in the Waldorf-Astoria Hotel under direction of Stanley E. Henwood, of Chicago, who has been appointed executive secretary of the conference. Arrangements for the conference will be directed from there by Mr. Henwood.

The program for the conference is being arranged by a seven-member advisory board which includes: Irvin Abell, M.D., clinical professor of surgery at University of Louisville; Morris Fishbein, M.D., editor of The Journal of the American Medical Association; David Lloyd, Ph.D., associate member of Rockefeller Institute for Medical Research; Kenneth Maxcy, M.D., professor of epidemiology at The Johns Hopkins University; Rustin McIntosh, M.D., professor of pediatrics at Columbia University; Frank Ober, M.D., professor emeritus of orthopedic surgery at Harvard University, and Thomas Rivers, M.D., director of Hospital of the Rockefeller Institute for Medical Research.

In addition to the sessions, there will be a scientific exhibit section, demonstrations of muscle testing and treatment procedures, and a film program. Coordinating this phase of the conference will be an advisory committee of Thomas G. Hull, Ph. D., director of scientific exhibits of The American Medical Association, and Charles F. Branch, M.D., director of scientific exhibits of The American College of Surgeons.

Orthopedic Defects of Children

Improvement of educational opportunities for children with orthopedic defects who receive their schooling in hospitals and convalescent centers will be the subject of a special conference of educators on February 26 and 27 at the Hotel Ambassador, Atlantic City, N. J., in conjunction with the 74th annual convention of the American Association of School Administrators.

Office of Scientific Research and Development Abolished

President Truman signed the executive order abolishing the wartime Office of Scientific Research and Development, the duties of which were absorbed by the unified armed services. Dr. Vannevar Bush, former head of the Office of Scientific Research and Development, is chairman of the new research and development board set up within the national military establishment under the unification act.

National Medical Center Opened

The Mount Sinai-Duarte National Medical Center, a consolidation of the Jewish Consumptive Relief Association, the Los Angeles Sanatorium, and the Mount Sinai Hospital and Clinic was opened on October 1. The national headquarters of this center is located at 208 West Eighth Street, Los Angeles 14, California.

New Insignia for Army Physical Therapists

Department of the Army Circular No. 67 published December 11, 1947, authorizes the insignia to be worn by members of the Women's Medical Specialists Corps which will be a caduceus in silver with a monogram consisting of the letters "WS" in black superimposed thereon.

As soon as this new insignia is available, physical therapists will no longer be authorized to wear the caduceus with the letters "PT" superimposed.

Hospital Establishes Rehabilitation Clinic

Beth Israel Hospital has established a rehabilitation clinic designed for the treatment of patients disabled by cerebrovascular accidents and allied disorders. The purpose will be to treat and train such persons, the majority of whom would be in the upper age brackets and who also suffer from hardening of the arteries and high blood pressure, to live useful lives within the limits of their disability. At present, admission to the new service will be limited to ward and clinic patients.

Associate Director of Research

Theodore E. Boyd, Ph.D., formerly of the Loyola University School of Medicine, Chicago, was appointed to the newly created position of associate director of research for the National Foundation for Infantile Paralysis. As associate director Dr. Boyd will collaborate with Dr. Harry M. Weaver, director of research, in coordinating the foundation's program of study into the cause, control and treatment of poliomyelitis and allied virus diseases. A native of Ashland City, Tenn., Dr. Boyd received his Ph.D. from the University of Chicago, 1923. He was engaged in research and teaching in physiology at Loyola beginning in 1923 and was made chairman of the department in 1928. Since 1938 the National Foundation for Infantile Paralysis has allocated $6,953,256.66 for research.

Harry Eaton Stewart

Physical Medicine has lost another pioneer with the passing away of Dr. Harry Eaton Stewart on January 6th, 1948. Born in 1887, he graduated from Yale University Medical School in 1910. His early interest was orthopedics and physical education, developed through his work as an instructor in the Arnold School of Physical Education at New Haven. He joined the U. S. Army at the outbreak of World War I and soon became associated with the unforgettable Frank B. Granger, and acted under him as Assistant Director, Section of Physiotherapy, Office of The Surgeon General, U. S. Army, continuing afterwards as Supervisor of Physiotherapy, Bureau of U. S. Public Health Service, Washington, D. C., advancing to the rank of Major M.C. Returning to civilian practice at New Haven, he founded the New Haven School of Physiotherapy and acted as Attending Specialist in Physiotherapy, U. S. Marine Hospitals, New York and Consultant in Physiotherapy, U. S. Veterans Hospital, New Haven. In 1923 he published a small monograph, "Diathermy in Pneumonia," based on clinical work at the U. S. Marine Hospital No. 21 and in 1925 he published a comprehensive volume, "Physiotherapy — Theoretical and Clinical Application," which went into second edition in 1929. Dr. Stewart was a member of the American Congress of Physical Medicine since 1925 and a charter member of the New York Sosiety of Physical Medicine and its President in 1927. The Society passed a resolution at its stated meeting on January 7th, 1948, expressing its profound sympathy to Mrs. Harry E. Stewart and the American Congress of Physical Medicine joins in this expression of sympathy and of tribute to an earnest worker in a common cause.

Jessie P. Allen

Dr. Jessie P. Allen, one of the pioneer members of the Congress, died suddenly at her home in Beloit, Wisconsin. Dr. Allen, who received her medical education at Hahneman, was appointed to the Wisconsin State Board of Medical Examiners, was a Fellow of the Federal Medical Examining Board; Chairman of the Wisconsin Child Service Society, member of the National Women's Medical Society and was a member of or was honored by many other organizations. Who's Who in the World, lists Dr. Allen, one of the few residents of Beloit so recognized.

Edward Harris Fischer

We regret to announce the death of Dr. Edward Harris Fischer of Louisville, Kentucky. Dr. Fischer graduated from the University of Louisville School of Medicine. He limited his practice to Ophthalmology, Otology, Laryngology and Rhinology. Dr. Fischer has been a member of the Congress for many years.

George L. Forbes

Word has been received at the Congress office of the death of Dr. George I. Forbes of Burlington, Vermont. Dr. Forbes graduated from New York Medical College, Flower and Fifth Avenue Hospital. Dr. Forbes has been a member of the Congress for many years.

Thomas F. Hennessey

The death of Dr. Thomas F. Hennessey, of Swampscott, Mass., is announced. A member of the Congress for some time, Dr. Hennessey received his medical education at Tufts College, Medical School.

BOOK REVIEWS

RADIOACTIVE TRACERS IN BIOLOGY. AN INTRODUCTION TO TRACER METHODOLOGY. By *Martin D. Kamen,* Associate Professor of Chemistry, Chemist to the Edward Mallinckrodt Institute of Radiology, Washington University, St. Louis, Missouri. Vol. I of *Organic and Biological Chemistry, A Series of Monographs.* Edited by Louis F. Fieser and Mary Fieser, Harvard University, Cambridge, Massachusetts. Cloth. Price, $5.80. Pp. 433, with 38 illustrations. New York, New York, Academic Press, Inc., 1947.

The use of radioactive tracers in biology and medicine is a subject of the highest present interest. As much of the work is rather scattered in medical, physiologic and physical and chemical literature, a comprehensive text for the biologist and physician who wants to use this technic is of the greatest importance. Dr. Kamen has endeavored to write such a text. In it he has tried to provide an introduction of those concepts of physics which are basic and needed for the intelligent application of tracer methods. He has also presented a systematic and critical survey of existing tracer methods and he has tried to indicate the potentialities and limitations of these methods of biological and medical problems.

The first chapter deals with an introduction and description of the basic physics of atomic nuclei and radioactivity. In the second chapter the production of radioactive isotopes is discussed. While this is certainly not a chapter which is easily read by the biologist without mathematical background, there is enough description to cover the mathematical formulae so that the biologist will at least get the essentials of this chapter. Chapter 3 discusses the radiation characteristics of the tracer atoms. Of particular importance is chapter 4 which gives the basic principles and the data on the measuring instruments used in tracer research. Chapter 5 discusses the general methodology in tracer research while the next seven chapters discuss radioactive isotopes of different chemical materials, such as hydrogen, carbon, phosphorus, sulphur and others. Chapter 13 is devoted to a discussion of the radioactive isotopes of importance in biology, while the last chapter deals with visualization technic and medical applications.

It is obvious that the author has surveyed a tremendous amount of literature. References are found all through the book. For those physicians and biologists who want a fundamental understanding of the basic concepts and of the physical principles on which tracer methodology is based, this book is an absolute must. The direct medical applications are at present confined to only one chapter of this book. Undoubtedly, this book will go through many further editions. It is to be hoped that the author will endeavor to incorporate as much of the fast-growing literature in this field in the next edition of this book as possible. The book will then remain what it now is, a standard necessary for everyone who wants to acquaint himself with this most fascinating borderline field between physics and medicine.

HANDBOOK ON FRACTURES. By *Duncan Eve, Jr.,* M.D., F.A.C.S., Surgeon-in-Chief, Nashville, Chattanooga and St. Louis Railroad; District Surgeon, Louisville and Nashville Railroad; Associate Professor of Surgery, Vanderbilt University School of Medicine; Member of the Southern Surgical Society; Member of the American Association for the Surgery of Trauma; Chairman of the Committee on Fractures of the Medical and Surgical Section of the American Railroad Association; Member of the Committee on Fractures of the American College of Surgeons; Attending Surgeon, St. Thomas Hospital, Nashville, Tennessee; in collaboration with *Trimble Sharber,* A.B., M.D., Attending Surgeon, St. Thomas Hospital, Nashville, Tennessee. Cloth. Price, $6.50. Pp. 258. Illustrated. St. Louis, Missouri: The C. V. Mosby Company, 1947.

This book, as stated in the preface, is a handbook for medical students and for physicians who occasionally take care of orthopedic patients. All common and a few uncommon types of fractures are discussed in a very satisfactory manner. Dislocations are mentioned only in conjunction with fracture dislocations. The types of treatment discussed are standard and up to date, and the author's own findings in forty years of experience are presented authoritatively. Alternate procedures are occasionally discussed where indicated, but there is no long discussion, and repetition is kept to a minimum. The repetition which is present is utilized primarily for emphasis. The important features of diagnosis and treatment are clearly discussed and stressed. Pitfalls to be avoided and valuable minor aids, learned by long experience, likewise are included. Operative procedures are discussed adequately; however, the author does not describe methods of exposure, inclusion of which would make the section on open reduction and internal fixation complete.

The book is well organized and very readable. The printing is large and clear, the paper of good quality. Reproductions of roentgenograms frequently are not distinct, the pictures of pathologic specimens and slides are virtually not discernible but the photographs and sketches are quite adequate and to the point. The book can be highly recommended for the purpose for which it was written, namely, for the medical student and for the physician who occasionally takes care of fractures.

MASSAGE AND REMEDIAL EXERCISES IN MEDICAL AND SURGICAL CONDITIONS. By *Noel M. Tidy,* Member of the Chartered Society of Physiotherapy; T. M. M. G.: Sister-in-charge of the Red Cross Massage Clinic, High Wycombe. Seventh Edition. Cloth. Price, $6.00. Pp. 458, with 190 figures consisting of schematic diagrams and photographs. Baltimore: The Williams & Wilkins Company, 1947.

This is the seventh edition of a concise, well-ordered encyclopedia of didactic information about the use of massage and remedial exercise in various medical and surgical conditions. The disease entities are organized according to the various physiologic systems of the body, and each disease state is discussed in a rather fixed manner. The etiology, pathology and medical or surgical treatment of each disease is discussed very briefly, and the accepted methods of physical treatment are rather fully outlined. All of the physical treatments which are discussed are well standardized technics in general use.

Only slight alterations have been made in this edition. In the section on Raynaud's disease, a short description of carbachol ionization has been given which the author has definitely found helpful in the treatment of that disease.

It is believed that this book will prove valuable not only to the student in physical therapy, but also to the physician who is interested in learning some of the general technics employed in physical treatments.

LAW AND THE PRACTICE OF MEDICINE. By *Kenneth George Gray,* M.D., B.Sc., K.C. Cloth. Price, $1.50. Pp. 68. The Ryerson Press, 299 Queen St., W., Toronto 2, 1947.

One of the important factors that should make this book interesting to all members of the medical profession is that the author has had the experience and training in ground work to make this publication a timely and authentic source of information. This work, as it states, applies to law as practiced throughout the Dominion of Canada, and directs the reader's attention to provincial variations. While its subject matter deals chiefly with the Dominion of Canada, throughout this work it points out clearly the fundamentals of law in relation to the practice of medicine in the United States. The author has made the book readily comprehensive to any physician by including footnotes as "Index of Statutes, Cases" and as to where references may be had to other authentic texts on this subject. It is short, concise and well written in a comprehensive and understandable manner. If every practitioner of medicine would read and reread the contents of this book, there would be a far better understanding between the doctor and patient relationship as well as the judiciary, and malpractice action would be reduced to the most essential and necessary minimum.

The publishers have prepared a well bound volume of 68 pages on paper on which the printing is of the type that makes for enjoyable reading. This book is recommended to the profession as an authoritative, concise compilation of essential data which they should all read and have in their libraries with the principal hope that it would stimulate interest in medical-legal subjects and stimulate further reading of more extensive texts on the subject.

MEDICINE FOR MODERNS. THE NEW SCIENCE OF PSYCHOSOMATIC MEDICINE. By *Frank G. Slaughter,* M.D. Cloth. Pp. 246. Price, $3.50. New York: Julian Messner, Inc., 1947.

A large percentage of patients whom physicians see each day are ill mainly or solely because of an inborn hereditary tendency to nervousness, worrisomeness abnormal and painful ways of thinking and constitutional frailness. This book is a facinating story of the newest great advance in medicine. No longer do physicians separate mental and physical ailments completely. No longer do they consider the body a mechanism and the mind something apart which merely directs the body's conscious actions. In the concept of psychosomatic medicine, body and mind are one entity, working in close relationship. We know that illness makes us unhappy. This book shows us that unhappiness can actually make us ill.

Hippocrates undoubtedly recognized the necessity of treating both mind and body as a single unit. Strangely enough that knowledge seems to have largely disappeared with the death of this pioneer, to lie dormant for several thousand years until resurrected by an Austrian Jew named Sigmund Freud, little more than fifty years ago.

The author says, "Peptic ulcer is the simplest of all psychomatic disturbances, and also one of the most frequent. It is the first to admit of a complete explanation on an emotional basis, and certainly the best to use as a starting point toward understanding psychomatic illnesses, particularly those where several emotional conflicts overlap, causing the pictures they present to merge into each other."

The whole book is interesting but as specialists in physical medicine the chapter, "Fibrositis: The Fashionable Backache," will interest us. The author says: "As with most essentially psychosomatic conditions, a multitude of causes and new treatments have been 'discovered' from time to time for chronic muscle and joint pains. These include barometric changes, strain, toxic changes (bacterial, intestinal and metabolic), focal infection, trauma and physical fatigue. The very highest form of medical mumbo jumbo ever created, it seems certain, stated that focal infections of the teeth cause muscle pains in the upper half of the body, while in the lower half conditions depended on intestinal toxemia.

Massage is a standard treatment for inflamed muscles and equally valuable for inflamed emotions. The release of muscle spasm through heat and massage serves as a release mechanism for the underlying emotional spasm. . . ."

Dr. Slaughter takes up the most obviously psychosomatic illnesses and shows how they are all

within the ever widening province of psychosomatic medicine. A few weeks ago in the *Journal of the American Medical Association* there appeared an article "Psychosomatic Medicine That Every Physician Should Know." This book is a help to physicians to know this new science of psychosomatic medicine.

INTRODUCTION TO CLINICAL NEUROLOGY. By *Gordon Holmes,* M.D., F.R.S. Cloth. Pp. 183. Price, $4.00. Baltimore: The Williams & Wilkins Company, 1947.

As the title implies, this is truly an introductory treatise for medical students taking up the study of nervous system disease for the first time after completion of basic anatomy and neurophysiology. Following the first three introductory chapters on general orientation and methods of examination, the disorders of the motor and sensory systems are discussed and the common pathologic lesions described. Chapters are also devoted to special functions such as vision, posture and equilibrium, speech, the bladder and rectum, the autonomic system and the mental state.

The material is presented not in tabular or diagrammatic style, but much as one would lecture on the subject which markedly improves the readability. There are only a few diagrammatic anatomical sketches and no references. The inclusion of more illustrative material would aid the students. The author has achieved his purpose of preparing for the young medical student a good comprehensive, but still elementary, approach to study of the diseases of the nervous system.

FUNDAMENTALS OF NEUROLOGY. By Ernest Gardner, M.D., Assistant Professor of Anatomy, Wayne University, College of Medicine, Detroit, Michigan. Cloth. Pp. 336 with 133 illustrations. Price, $4.75. Philadelphia: W. B. Saunders Company, 1947.

This volume presents the principles rather than the details of neurology. It presents those facts necessary to present the subject as a series of basic concepts which can be the foundation for more detailed studies of specific phases of neurology. The material presented is based on dissection and microscopic study of the nervous system, analysis by experimental methods and the study of neurologic disorders.

Names were often given to portions of the body before the functions of these parts were known. For instance, an area of the brain which in general configuration somewhat resembles a sea horse, was named the hippocampus. Very often the name of the investigator who first described a structure became associated with that structure, as for example, the vein of Galen.

There are certain terms and methods of description used in anatomy which are indispensable in any discussion of the nervous system. These are, in general, based on an almost worldwide standardization of terminology which uses Greek and Latin root words. By this means confusion arising from local and national idiom is avoided. As an aid there is at the end of this volume a glossary of many of the new terms with their Greek or Latin derivations.

Aside from those engaged in medical studies, there are many who are interested in the fundamentals of neurology. A knowledge of normal mechanisms is of basic value in zoological and psychologic studies and is the aim of specific courses in neurology in departments of zoology. Nurses, physical therapists, and occupational therapists are frequently in contact with patients whose neurologic disorders present what appear to be complex and unexplainable symptoms. To these students neurology is often presented as a mass of anatomical data, a sequence of physiologic events, or a collection of signs and symptoms, none of which appear to be clearly related. This presentation of the basic principles of the neurology is highly applicable.

THE CEREBRAL PALSIED CHILD AND HIS CARE IN THE HOME. Prepared by *Viola E. Cardwell,* R.N., M.A. Paper. Pp. 196. Price, $1.00. New York, Association for the Aid of Crippled Children, 1947.

This is a valuable compilation of information for physicians, technicians and parents to aid in teaching what is adequate care for the cerebral palsied. Practical details of physical and occupational procedures are described as well as essential features of diagnosis and of the pathologic changes. The overall problem of rehabilitation including mental hygiene and education is also discussed in a realistic way. All interested in cerebral palsy will want this book.

THE NATIONAL FORMULARY. National Formulary VIII. N. F. VIII. Prepared by the Committee on National Formulary under the supervision of the Council, by Authority of the American Pharmaceutical Association. Official from April 1, 1947. Eighth edition. Fabrikoid. Price, $7.50. Pp. 850, with illustrations. (Distributed by Mack Printing Co., 20th and Northampton Sts., Easton, Pa.), American Pharmaceutical Association, 2215 Constitution Ave., Washington 7, D. C., 1946.

The arrangement of mongraphs on drugs and titles is different from the plan followed in previous editions. Latin titles are continued but are preceded by English titles. Monographs are arranged in alphabetic sequence but in a different order than heretofore so that a monograph on a basic drug is followed by monographs on its official preparations. In order to facilitate the use of the new arrangement, a marginal index is included. This departure from traditional arrangement is one of the most noticeable innovations to be found in this edition. Greater emphasis than heretofore has been placed on the use of the metric system. All doses are expressed in the metric system of weights or measures, printed in bold face type followed in parentheses by the approximate equivalent in the Apothecaries' system in less prominent type.

CHEMISTRY OF MUSCULAR CONTRACTION. By *A. Szent-Györgyi,* Department of Biochemistry, University of Budapest. Cloth. Pp. 150. Price, $4.50. New York: Academic Press, Inc., 1947.

This monograph represents the outstanding biochemical studies on muscular contraction presented in the Cameron-Prize Lecture at the University of Edinburgh in 1946. The biochemical and biophysical properties of myosin, actin and actomyosin are presented with the laboratory evidence. A plausible theory of contraction is propounded with discussion of the states of excitation, contraction, relaxation, rigor and contracture. A working knowledge of modern biochemical methods is prerequisite for appreciation of the text. All research workers in the field should find this a highly desirable and convenient reference to the author's fundamental contributions to our knowledge of muscle function.

SKIN MANIFESTATIONS OF INTERNAL DISORDERS. By *Kurt Weiner,* M.D., Dermatologist, Mount Sinai Hospital, Deaconess Hospital, St. Michael's Hospital, Milwaukee, Wisconsin. Cloth. Pp. 660 with 386 illustrations and 6 color plates. Price, $12.50. St. Louis: The C. V. Mosby Company, 1947.

The author has correlated skin observations with systemic infections varying from pyogenic septicemia to the contagious diseases and Weil's disease. The section on the rickettsial diseases is quite descriptive. The discussion and illustrations for disseminatus lupus erythematosus is excellent. Another feature is the description and illustrations concerning skin manifestations in metal poisonings. The author in an interesting and helpful manner attempts to strengthen the unity of medical specialties with this extensive work.

FOOD AND NUTRITION: THE PHYSIOLOGICAL BASES OF HUMAN NUTRITION. By *E. W. H. Cruickshank,* M.D., D.Sc., Ph.D., Regius Professor of Physiology in the University of Aberdeen, Aberdeen, Scotland. Cloth. Price, $4.50. Pp. 326, with 41 illustrations. William Wood & Co., Mt. Royal and Guilford Aves., Baltimore 2, Maryland, 1946.

In his introduction the author states that he is presenting a brief survey of our present knowledge of the physiology of food and nutrition and of the means whereby Great Britain met the problems of feeding the nation during six years of war. The author further states that the war has emphasized "with harshness and urgency" the need of a greater production and better distribution of food in the interests of the nutritional status of people and that it may not be too much to say that the "hope of World Peace depends upon it." Many of the chapters are devoted to well known topics such as the protein requirements of the body, the energy requirements of the body and mineral salts in nutrition. The chapters on vitamins are interesting, in view of the public interest in the synthetic use of individual vitamins. The author points a word of caution in any attempt to improve diets by the indiscriminate addition of large supplements of single synthetic vitamins. Insufficient knowledge of the many interrelated reactions of vitamins demands caution in the therapeutic use of synthetic vitamins and emphasizes the value of a mixed diet supplying all accessory food factors in their natural state. Another interesting chapter is one devoted entirely to bread, in which the merits of what type of flour to use are well presented. Dehydration and preservation of foods is a timely subject because of all the frozen products now on the market. The book is not intended as an elementary food textbook and is recommended for the physician as well as the medical student.

CALCIUM AND PHOSPHORUS IN FOODS AND NUTRITION. By *Henry C. Sherman,* Mitchill Professor Emeritus of Chemistry, Columbia University. Cloth. Price, $2.75. Pp. 176. Columbia University Press, Morningside Heights, New York, N. Y.

A book by the author whether new or a revision is always welcomed to those interested in this field. It is written for the student as well as the professional worker whether in teaching or in practical dietetics, research, nutrition policy, or food management. Written in not too technical language it discusses in a rather convincing manner the great importance of these minerals. The general knowledge if carefully studied would seem extremely valuable to the study of bony structure and generally to the growth and development of the human as compared with the animal. Much research work has been based on animal experimentation but there is still a great gap in applying the results to the human. A selected bibliography occupies about one-third of the book.

THE ENDEAVOR OF JEAN FERNEL. By *Sir Charles Sherrington,* O.M. Cloth. Pp. 223. Price, $3.50. Cambridge, at the University Press; New York: The Macmillan Company, 1946.

This is an interesting account of the life of Fernel who might be termed the father of physiology. This sixteenth-century French physician is revealed as an eminent scholar and author who turned to medicine in his thirties and became an outstanding figure of his time because of his modern views and keen literary ability. This book should be welcomed by all interested in the history of medicine.

PHYSICAL MEDICINE ABSTRACTS

Conservative Treatment of Semiulnar Cartilage Injuries of the Knee Joint. Nelson J. Howard.

Am. J. Surg. 74:647 (Nov.) 1947.

Treatment of the patient with semiulnar cartilage injury consisted of reduction of the cartilage by manipulative measures, if possible, aspiration of joint fluid if the joint was tense and distended, application of a heavy voluminous sheet wadding bandage, held by elastic bandaging and the use of crutches or a cane, advising the patient at the same time to be recumbent as much as possible. Those patients in whom reduction of the slipped meniscus could not be carried out by manipulation were placed in traction in bed. It soon became evident that patients so treated absorbed the joint effusion much quicker, the cartilage was less likely to displace after reduction and their convalescence less prolonged. At first, sheet wadding and elastic bandages were used as the only immobilization after traction reduction. This had to be reapplied constantly. A circular unpadded plaster splint, reaching from the ankle to the upper third of the thigh, was found to be the most satisfactory form of immobilization. Slipping and shifting of the splint was prevented by adhesive strips the length of the leg beneath the cast, turned back and incorporated into the plaster above the malleolid.

In a small carefully studied series of traumatic knee joint lesions, diagnosed as semilunar cartilage injuries, 82 per cent (forty-six patients) were successfully treated by conservative means; 18 per cent (ten patients) were operated on. The treatment advised is immediate hospitalization, manipulative or constant adhesive traction reduction of the locked joint, aspiration of the joint, if necessary and immobilization of the injured knee by circular plaster splint. It is shown that the earlier complete rest of injured joint is enforced, the more likely is the success of the conservative treatment, and conversely, the longer the delay in instituting treatment, the more certain will operative intervention be required. Pathologic, anatomic studies of the injured meniscus in patients and experimental work on animals reported by many observers provide a sound logical basis for the success of conservative therapy.

The Causes and Treatment of Sciatic Pain. Charles Gray.

Surg., Gynec. & Obst. 85:431 (Nov.) 1947.

The patient is allowed to lie in whatever position he finds most comfortable. The best plan is to support the patient with pillows in whatever position he obtains most relief from pain Radiant heat or diathermy may be applied daily. Massage should not be used. Light massage is useless and deep massage is too painful. While the patient is anesthetized, the sciatic nerve is stretched by flexion of the hip, the knee being held in full extension and the ankle in full dorsiflexion. The flexion of the hip should be forced as far as possible, short of dislocating the joint. "Adhesions" may be heard to give way in the thigh during this maneuver. Manipulation of the spine is performed under pentothal anesthesia. If combined with epidural injection it should be done first, while the relaxation is complete. The method described by Bankart is used.

There are four movements to be carried out, namely: 1. The surgeon stands on the right hand side of the supine patient and places his right arm under the patient's knees. He lifts the legs up, flexing the hips and knees and carries the knees upward until they are pressed on the patient's chest. The fullest possible flexion of the lumbar spine is thus obtained.

2. The patient lies on his right side. The left leg hangs over the side of the table and the left arm is placed behind the patient's back. The surgeon leans with his right forearm on the left iliac crest, while with his left hand he grasps the left shoulder. A forcible rotatory movement of the sacroiliac joint is produced by pulling the iliac crest forward and pushing the shoulder backward.

3. The surgeon goes to the other side of the table and the patient is turned on to his left side. The maneuver described in (2) above is repeated.

4. The patient is turned on his face. With his left arm the surgeon lifts the patient's legs until they are almost vertical, and with his right hand presses downward over the lumbar spine, extending it as much as possible.

The manipulation is followed by a course of spinal exercises, radiant heat and deep massage.

A Comparative Study of Thromboangiitis Obliterans in White and Nergo Patients. H. A. Davis, and L. D. King.

Surg., Gynec. & Obst. 85:602 (Nov.) 1947.

The outstanding difference between the two groups lay in their response to treatment. Conservative treatment, that is, nonsurgical treatment, was conspicuously less successful in negro than in white patients. The incidence of amputations was significantly higher in negro patients than in white. The greater lack of cleanliness among negro patients may predispose to infection of the poorly vascularized tissues. There may be a racial lack of resistance to this disease in the negro. If this were so, the disease should occur more frequently than it does in this race. Indeed, there is some evidence that the opposite may be true, namely, that some degree of racial immunity to Buerger's disease may exist among negroes. Two

facts would tend to support this view. First, the disease is less common in negroes. Second, in the present series of cases the incidence of minor amputations was significantly higher in the negro patients than in the white patients when compared with the incidence of major amputations.

The Mobility of Bone.

In Current Comment, J. A. M. A. 135:514 (Oct. 25) 1947.

The introduction of the use of stable isotopes in experimental biology soon resulted in the demonstration that protein of the body exists in equilibrium with the tissue amino acids and that it is constantly being broken down and resynthesized. In 1945 it was reported that precipitates which are formed from solutions of the approximate inorganic composition of blood have a composition similar to the inorganic portion of bone and that the solubility of these precipitates corresponds closely to the amount of calcium and phosphate present in the plasma. The experimental use of radioactive phosphorus resulted in demonstration that phosphate of bone is rapidly exchanged in the living animal with the phosphate of serum; this exchange with whole bone occurs almost as rapidly as the exchange between powdered bone and the surrounding solution. Since the reaction appears to occur on the crystal surfaces of the bone, such mechanism apparently facilitates diffusion of the phosphate through the bone. These experiments show the exchange relations which exist between the bone and the tissue fluids and also support the thesis that the diet influences the healing of fractures and the health of the bones.

Physiotherapy in War Injuries of Peripheral Nerves. I. Yu. Tarasevich; Kh. M. Freidin, and A. R. Shugam.

Am. Rev. Soviet Med. 4:391 (June) 1947.

All patients received mud baths every other day alternating with artificial sulfur hydrogen baths. Each course included fifteen to seventeen mud treatments at 42 to 46 C. for fifteen to twenty minutes, and twelve to fifteen baths of artificial sulfurated hydrogen (concentration of 150 mg. per liter) at 35 to 36 C. lasting two to twelve minutes. In causalgia the temperature of the mud was reduced to 38 to 40 C. Five patients who suffered particularly stubborn pain were treated with novocain block by Vishnevski's method. All the patients also were given physical exercises and massage.

Atrophied muscles did not respond readily, although an increase in size was observed in most cases. Physical training contributed to the increased size of the muscles. In 12 of 18 patients with diminished or absent reflexes of the upper extremities, improvement was noted. Restitution of absent reflexes in tendon Achilles was not observed. Twenty-two of 39 patients on whom electrical responses were carried out showed a return of partial reaction of regeneration at the end of treatment.

Patients in the third group had received a second course of treatment followed by partial recovery. Six patients showed a certain amount of improvement with the first course of treatment, but after two to three months there was no more improvement. They were admitted to the Institute for a second course of balneotherapy and physical culture which acted as a fresh stimulus to the latent reparative processes.

Electrolysis. Harry M. Robinson.

South. M. J. 40:6191 (July) 1947.

It is only when the needle and holder are attached to the negative pole, that the operator may attempt the process of electrolysis, for the removal of superfluous hair and the destruction of benign growths. The patient meanwhile holds a metal barrel conductor or wet sponge which is connected to the positive pole electrode and which must be in contact with the skin if the circuit is to be completed.

The area to be treated may be sponged with 70 per cent alcohol for asepsis, but in the cases in which we did not precede the process with the alcohol swabbing there has been no infection.

Moles or pigmented nevi can be removed by a trained operator with less scarring by electrolysis than by high frequency dessication. Senile sebaceous adenoma, seborrheic keratoses, small hypertrophic scars, papillary varices and verrucae can all be removed satisfactorily in the same manner as pigmented nevi.

In the treatment of nevus araneous (spider nevus) one must find the central supply vessel of this lesion and inserting the needle perpendicularly into it occlude the vessel and thereby destroy the small tributaries.

The Place of Physical Medicine in General Practice. J. F. Nash.

South. Med. & Surg. 109:41 (Feb.) 1947.

Popularity of physical therapy ebbs and flows. We are now at a period of flood. There can be little doubt that most physicians neglect to get for their patients all the good possible from this form of treatment. Zeiter's article appeals because it says the man doing general practice is competent to do most of his own heating, rubbing and manipulating. Physical therapy is needed in most cases of fracture: heat through infra-red irradiation, whirlpool baths, hot packs or heat cradle; massage, light, in the direction of venous return; muscle stimulation effected by muscle "setting" while the part is in the cast, voluntary motion or electrical stimulation; and exercises including occupational therapy to develop the use of the impaired part.

Local applications of cold, with rest, proper compression bandaging, and elevation are indicated for immediate treatment. Later, splints or bandages should be removed and replaced after daily heat treatment with the whirlpool bath or infra-red generator. The heat treatment is followed by massage.

Occupational therapy is to be planned and carried out from the viewpoint of functional, diversional and prevocational value.

Graded Leg Exercises. Joseph K. Narat, and Arthur F. Cipolla.

Surgery **21**:861 (June) 1947.

The efficiency of postoperative exercises in prevention of pulmonary embolism is attested by Erskine and Shires who reported that the incidence of fatal embolism after abdominal operations was reduced by more than one-half following introduction of postoperative exercises and massage. Shaw and Rickards found fatal embolism to be five times more common in a hospital where exercises are not included in the postoperative treatment as compared with another institution where exercises are carried out as a routine.

While the value of leg exercises has thus been established, certain disadvantages of the devices now in use must be mentioned: most of them are bulky and either take considerable space in the bed, interfering with the patient's comfort, or protrude from the bed, blocking the free passage in the room; patients must be uncovered to perform the exercises; some devices are impractical or expensive or both; they are time consuming because they require supervision; finally, they provide no facilities for registration which is essential because pain, lack of interest, or lassitude caused by sedation may prevent the patient from faithfully carrying out the prescribed order.

Visual Diagnosis of Eye Diseases by Means of Infra-Red Radiation. A. Vasko, and M. Peleska.

Brit. J. Ophth. **31**:419 (July) 1947.

The authors report experiments with image converters which are sensitive to infra-red radiation in an attempt to aid the diagnosis of certain diseases of the eye. Studies were made of normal as well as pathologic tissues of the anterior and posterior parts of the eye and the possibility of seeing through opacities of all the component parts of the eye. Observation in infra-red light proved to be especially useful as a complement to the conventional methods of ophthalmologic diagnosis before transplantations of the cornea and similar.

Wound Disruption and Early Ambulation. John C. Burch, and Cloyce F. Bradley.

Ann. Surg. **125**:768 (June) 1947.

Early ambulation is a valuable method in the management of postoperative patients. Based on sound physiologic principles, it not only reduces the incidence of vascular and pulmonary complications, but appreciably shortens convalescence. These clearcut results have won it many advocates. Nevertheless, there is still a certain deep-rooted scepticism concerning the danger of wound disruption. This is the greatest deterrent to the general acceptance of the method.

It may be said that early ambulation does not affect the abdominal wound adversely. The satisfactory wound healing, observed following early ambulation, may be attributable to a better nutritional state, as well as a lowered incidence of the many complications favoring disruption, such as vomiting, cough, distention and urinary retention. It is a safe procedure of great benefit to the patient, and its possibilities in decreasing hospitalization are as yet unrealized.

Osteochondritis Dissecans of the Talus. R. Beverly Ray, and Edward J. Coughlin.

J. Bone & Joint Surg. **29**:697 (July) 1947.

Postoperative immobilization is dependent on the type of approach used, and is unnecessary unless an osteoplastic or tendoplastic procedure is employed. Similarly, weight-bearing and active motion are allowed as soon as the healing of the operative trauma permits. If a purely soft-tissue approach is used, active use of the part is usually begun within from ten to fourteen days. Postoperative physical therapy is not required, but whirlpool baths and supervised active motion may hasten convalescence.

Use and Abuse of Physical Therapy in the Treatment of Arthritis. Eugene F. Traut.

Ill. M. J. **92**:238 (Oct.) 1947.

The interest of the patient with arthritis in ridding himself of pain, stiffness and deformity as rapidly, thoroughly and cheaply as possible must be kept constantly before us. At the first contact the patient must be given a proper perspective of his ailment and its chronicity. He should be told of the ultimately favorable outlook for most cases as justified by experience.

The patient must be prepared to carry on his management long after stopping formal treatment. Do not fail to prepare the patient for the possibility of having to modify or even radically change methods of treatment already instituted but found not to be effective in his particular case. Failing to tell the patient of such possibility may convince the patient that you "are just experimenting." There is really much reason for the latter presumption.

As Coulter has so often emphasized, the patient must be told that the physical therapy employed in the office or hospital will be supplemented and followed by prescribed physical measures at home. The formal measures employed in a department of physical therapy are limited by the time of the operators, the roominess of the department and by the patients' purse to such a degree as to really constitute an ineffectual effort against a condition as stubborn as chronic joint disease.

Physical measures in the treatment of rheumatic disease should not widely deviate from the principles of rest, exercise, heat and massage.

Physical therapy for arthritis requires, besides the services of a competent operator, a lamp for surface heat, an ultraviolet generator for its tonic effect and for the treatment of inflammatory soft tissues, a galvanic generator for ion transfer and diathermy apparatus for the deep heating of joints, muscles, tendons, ligaments and the periarticular structures. In many instances the heat lamp is preferable to diathermy. One of these forms of heat, usually that from an infra-red generator is used to relax the muscles preliminary to

massage. Erythema doses of ultraviolet are useful in the treatment of involvement of soft tissue fibrositis.

Of importance is the training of the patient and of the patient's family. The active elements of physical medicine such as exercise and the use of heat can be managed by the patient himself.

The Effect of Body Posture on Uterine Position. A. N. Diddle; William F. Mengert, and Ruth Maxwell Sanders.

Am. J. Obst. & Gynec. **54**:391 (Sept.) 1947.

Passage of time is important in any consideration of uterine mobility, since intestines must be displaced before profound change is possible. Moreover, uterine weight, effective for intestinal displacement, is small in relation to that of viscera displaced. Therefore, the rate of change is slow and depends to some degree on intestinal peristalsis.

It is commonly taught that the anteverted uterus cannot prolapse. In other words, the uterus must assume midposition or become retroverted before descent begins. This was not the case in the patient with incomplete prolapse, since descent occurred with the uterus anteverted, and the canal practically horizontal as she stood erect. Moreover, complete prolapse of the anteverted uterus following the Watkins-Wertheim interposition operation does occur. Such a patient was observed by the authors.

It is apparent that maintenance of uterine station and cession depends on integrity of fascial support. In contradistinction, the uterine body bends (flexion) and turns (version) on a transverse axis as a result of the combined influences of its muscular tone, position of the intestines, body posture and the tilt of the pelvis. It was clearly demonstrated that the normal uterus tended to gravitate in conformity to the several positions assumed by the subject. This tendency was distinctly evident in the normal, and greatly exaggerated in patients with uterine prolapse.

Role of the Sympathetic Nervous System in Traumatic Surgery. H. Gurth Pretty.

Am. J. Surg. **74**:528 (Nov.) 1947.

Refrigeration will inhibit pain, reduce edema and produce dilatation of the capillaries. When, however, the refrigerated limb is allowed to approach room temperature, the response is acute and excruciating pain and massive edema with blebs and fever.

Refrigeration should be used only in cases in which amputation is inevitable. Interruption of the sympathetic inhibits pain, prevents or reduces the edema and produces vasodilatation, temperature rise and dryness. Another phenomenon develops, situated at the junction of ice and air, or rather just above the area of refrigeration which resembles venous thrombosis. In patients refrigerated for several days the skin in this area undergoes necrosis or if incised for amputation purposes undergoes necrosis. Sections of these areas have been prepared and it was found that venous thrombosis was not present but present were dilated vessels and venous stasis. Refrigeration is carried only to the mid-calf when amputation is considered above the knee and the actual amputation is carried out under cyclopropane anesthesia.

Streptomycin in Ophthalmology. John G. Bellows.

Am. J. Ophth. **30**:1215 (Oct.) 1947.

The penetrability of the cornea to streptomycin may be increased by abrasion, inflammation, ion transfer and wetting agents.

Streptomycin is safe and nonirritating to the surface of the eyeball in concentrations up to 10,000 mogm, per ml. Higher concentrations delay the regeneration of the epithelium and promote scarring and vascularization of the cornea.

Vitreous Infections and Streptomycin. Irving H. Leopold, and Richard Dennis.

Am. J. Ophth. **30**:1345 (Nov.) 1947.

Penicillin has been shown to penetrate poorly from the blood stream into the vitreous humor of the normal and inflamed eye. Corneal baths, corneal ion transfer, subconjunctival and anterior-chamber injections produced higher intravitreal concentrations of penicillin than did the systemic route. However, although these local measures and massive systemic doses had some success in controlling experimental vitreous infections, not one was as effective as direct intravitreal injections of penicillin.

Corneal ion transfer subconjunctival injection can give high concentrations in the anterior chamber but not as high as those reached by direct anterior-chamber injection. It apparently requires high anterior-chamber concentrations of drugs such as streptomycin and penicillin in order for them to pass posteriorly through the iris-lens barrier. In an effort to find another method by which these antibiotics could reach the vitreous without direct intraocular injection, further studies with ion transfer were undertaken.

Pentothal and Curare for the Modification of Electric Convulsions. Jesse D. Rising.

J. Kan. M. Soc. **48**:456 (Oct.) 1947.

Pentothal decreases both apnea and excitement incident to induced electro-shock. Curare does not raise the convulsive threshold and is efficient in softening the seizures, but the range of therapeutic dosage is dangerously narrow. A combination of pentothal and curare satisfactorily modifies electrically induced convulsions, permits the use of smaller amounts of curare and is accompanied by less impairment of breathing than that which frequently follows electric shock preceded by therapeutic doses of curare.